DOCUMENT RESUME

ED 389 523 SE 056 803

AUTHOR Finson, Kevin D.; Beaver, John B.
TITLE The Status of Science Education in Illinois Scientific Literacy Target Schools, K-6, 1994. A Study.
INSTITUTION Western Illinois Univ., Macomb. Coll. of Education.
SPONS AGENCY Illinois State Board of Education, Springfield.
REPORT NO SLPN-E70222
PUB DATE 30 Jul 94
NOTE 99p.
AVAILABLE FROM Western Illinois University, College of Education, Macomb, IL 61455.
PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Demonstration Programs; *Educational Change; Educational Environment; Educational Facilities; Elementary Education; Financial Needs; Observation; Parent Participation; Questionnaires; School Community Relationship; Science Curriculum; *Scientific Literacy; *State Aid
IDENTIFIERS *Illinois

ABSTRACT

The Illinois State Board of Education's Scientific Literacy Project provided extra funds to certain schools with the intent of creating demonstration schools useful as models for other schools to improve their science education programs. The study described in this document examined the impact of these funds on the target schools and attempted to determine how these schools differed from schools in general within the state. The sample population consisted of elementary teachers in the target schools. The data collection methods included questionnaires, teacher comments, and observations. Findings include the following: (1) despite Scientific Literacy monies, many teachers feel financial support to be inadequate; (2) science is taught more frequently and for longer periods of time; (3) teachers use activity-based science, make use of supplemental curricula, and integrate science with other subjects; and (4) facilities are old and inadequate. The document presents detailed findings in the following areas: demographics; curriculum; instructional process; assessment; leadership; staff effectiveness; school environment; parental involvement; and school-community relations. It also contains implications and recommendations, statistical tables, figures, and graphs. Four appendices include: written survey instrument and cover letter; site survey instrument; list of site survey personnel; and raw data. (JRH)

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ED 389 523

A Study of the Status of

Science Education in Illinois Scientific Literacy Target Schools, K-6, 1994

By Dr. Kevin D. Finson
Dr. John B. Beaver

SE050803

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This publication was produced by funding from the Illinois State Board of Education, Springfield, Illinois (Scientific Literacy Project Number E70222). The writer/producer accepts full responsibility for the views expressed herein. The views expressed are not intended to represent those of the Illinois State Board of Education.

SCIENCE EDUCATION IN ILLINOIS SCIENTIFIC LITERACY TARGET SCHOOLS, K-6, 1994

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Preface

This is a followup to a watershed study conducted in 1993 which followed two previous similar studies in 1975 and again in 1987. Each study provided a snapshot of the state of science education in Illinois and taken together begin forming a picture of science education in Illinois over the past two decades. In the latter few years, extra funds have been provided to a somewhat limited group of schools through the Illinois State Board of Education's Scientific Literacy Project with the intent of creating demonstration schools useful as models for other schools to follow in improving their science education programs. The study described in these pages examined the impact of these funds on these "target schools," and attempted to determine how these schools differed, if any, from schools in general within the state.

In general statewide, the problems in science education have been persistent and reasonably stable over time, as substantiated by the 1993 study. However, attention and monies from the Scientific Literacy Project have allowed Target Schools to break these trends. The following appear to support this claim:

1. **Financial Support Lacking**
   Financial support for science instruction is inadequate in 75% of the state's schools in general and in 71% of the Target Schools, as reported by classroom teachers. Teachers report they lack materials, kits, and supplies to support science instruction. Many teachers report spending their own money to purchase needed science supplies. Even with Scientific Literacy monies, many teachers still feel financial support to be inadequate. Concerns are growing about what will happen to the science programs developed and established with Scientific Literacy funds once those funds cease to flow into the schools.

2. **Science Taught Last**
   In general, science instruction typically comes last on the elementary school day schedule in many schools, and is usually not taught daily. In the Target Schools, science is taught much more frequently and for longer periods of time, usually daily, and is highly valued.

3. **Textbook Dominance**
   1993 data underscore that the textbook is THE science curriculum in most Illinois schools. Too many schools continue to ignore the necessity of activity-based programs in science. Teachers say reading and math are the main diet and science is simply not emphasized. The picture is different in Target Schools. Although the textbook is still used often, it is no longer the single determinant of curriculum. Target School teachers have embraced activity-based science, make use of supplemental curricula and materials, and attempt to integrate other subjects with science so that science is taught daily.

4. **Facilities are Old and Inadequate**
   In 1993, teachers reported facilities do not make it easy to teach science. Sinks and water are not available, rooms lack sufficient electrical outlets, furniture is old and not designed for science teaching, and so forth. Teachers are being asked to teach the year 2000 science in 1900's school facilities. The infrastructure is aged and in many cases inadequate. The same picture holds true for Target Schools.

5. **Teaching and Administrative Staffs Are Not Pulling Together**
   Data from the 1993 study indicated that teachers and principals simply did not see eye to eye on most science education issues (over 90%) in their schools. This is indicative of two sectors of the educational community that both address scientific literacy concerns, but are pulling in different directions rather than together. Target School teachers and principals disagreed on fewer than 70% of such issues, but this percentage is still far too large for effectively addressing the issues.

8. **Time Spent Teaching Science Daily**
   Since 1975, the time devoted daily to science instruction has declined. In 1975, teachers spent an average of 23.4 minutes per day to science. By 1993, that had dropped to 14.7 minutes. In the Target Schools, an average of 34.16 minutes per day are devoted to science instruction. Clearly, if scientific literacy is the goal for our students, then adequate time must be spent on science. The efforts in the Target Schools are more likely to succeed in attaining this goal than are those in the state's schools in general.

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Science Education in Illinois Scientific Literacy Target Schools, K-6, 1994

INTRODUCTION

What is the status of science education in Illinois' Scientific Literacy Target Schools in Kindergarten through sixth grades in 1994? How does the status of these Target Schools compare to the status of science education in the state's K-6 classrooms in general? This project was designed to take inventory in classrooms and provide a state-wide snapshot of the science teaching presently occurring in those schools which have been designated as Target Schools and which have received Illinois Scientific Literacy Project funding.

The last state-wide elementary science assessment was conducted in 1993 by Dr. Kevin Finson at Western Illinois University and Dr. Tom Fitch at Illinois State University. That assessment attempted to generally assess the status of science education in Illinois K-6 classrooms across the state. Prior to that study, the next most recent assessment was conducted in 1987 by the Honors Science Teachers Project at Illinois State University in 1987, which followed a comparable study conducted through Illinois State University in 1975. Both the 1987 and 1975 studies results have been published in the respected national scholarly journals, the *Journal of Research in Science Teaching* and *Science Education*.

The questions raised in the present study include: What science is being taught? How is this science being taught? Who is teaching this science? Are the persons teaching this science well prepared to teach children science? Are instructional materials to teach children science readily available and adequate? Are the state goals for learning in science evident in planning and providing science instruction for children? How do the answers to all these questions compare between the Target Schools and schools in general throughout Illinois? These and other questions were posed on a questionnaire completed by teachers who teach science in 242 Scientific Literacy Target Schools. Unlike the 1,285 schools sampled in the 1993 study, the schools selected for the 1994 study were not randomly selected, but rather comprised the entire population of Target Schools receiving funding through ISBE's Scientific Literacy Program office. As with the 1993 study, school site visits by skilled trained observers followed-up the teacher completed questionnaire survey. There were 30 on-site school visitations to verify the written questionnaire responses from teacher respondents. These results reflect the state of science education in Illinois Scientific Literacy Target Schools in 1994.

This statewide view is needed to support decisions made by policy makers, law makers, funding sources, and scholars. The State of Illinois needed to collect this data to assess the effects of the 1985 statewide reform legislation and the adopted state goals for learning in science, particularly as it related to Scientific Literacy funds expended on selected schools (the Target Schools) across the state. The documentation provided by this study presents insights regarding scientific literacy which are otherwise not available to state officials. Qualitative data collected by trained observers to school sites augmented the quantitative data collected by responses to written questionnaires. Thus, information not commonly available was collected and analyzed by researchers in this study. This study provides information which augments the baseline data obtained through the 1993 study.

This study involved:

1. 242 mailed written questionnaires (largely forced-choice items),
2. Many unsolicited teacher comments written in the margins of the returned written questionnaires,
3. Forty school follow-up site visits by trained observers who provided written reports,
4. Forty K-6th grade elementary-school teachers' and their principals' views of science education in their schools,
5. A written response rate of 94.2% of the 242 selected teacher participants (n = 228 responded), and
6. Using identical items and categories of inquiry used in the 1993 study so that direct comparisons between the studies could be made (many items and categories of inquiry were also similar to those of previous studies in 1975 and 1987, making possible comparisons and identification of trends over time).

PROCEDURES

Population

The population of interest in this study was every elementary school teacher (K-6th grades) teaching in a self-contained or departmentalized science classroom in Scientific Literacy Target Schools in the State of Illinois. This is the group to whom the researchers attempted to generalize the results.

Study Sample

Although the population of Scientific Literacy Target School teachers in Illinois is relatively small compared to the approximately 36,379 certified K-6 teachers in the state, the study sample itself was the population. Since the majority of Target Schools had teams of teachers participating in the Scientific Literacy projects ongoing within the schools, the "lead teachers" of these teams received the questionnaires and, when selected, site visitations. The sample represented each geographic region throughout the State of Illinois. The sample population . . .

- Was not randomly selected;
- Consisted of elementary classroom teachers of grades K-6 who teach children science;
- Consisted of 242 Scientific Literacy teacher teams' lead teachers in each school;
- Each lead teacher received a survey packet containing a questionnaire and cover letter eliciting the teacher's responses;
- Number of participants per school = 1 teacher per school, 242 schools;
- Over 16% of the total responding teachers received a follow-up school site visit and interview by a trained observer (n = 30); and
- Ten trained experienced observers conducted site visits to schools from which written survey responses were obtained

Instrumentation

Survey Questionnaire. The survey instrument used in this study was identical to that for the 1993 study. The instrument, administration procedures, site visitation checklist, school site visitation protocols, and site visitation personnel were kept identical to those used in the 1993 study. The instrument was developed from 281 survey items generated from other previous survey instruments as well as from questions addressing Illinois systemic

change processes and the Illinois State Goals for Learning in Science. These items clustered in the State Systemic Initiative (SSI) cores:

1. Curriculum
2. Instructional Process
3. Assessment
4. Leadership
5. Staff Effectiveness
6. School Environment
7. Parental Involvement
8. School-Community Relations

The survey instrument consisted of 77 items in a four-page printed booklet format (See Appendix A). Seven items sought demographic information. Five items employed a semantic differential scale, one item included a rank-ordering response format, and twenty items used a five-point Likert-type scale indicating the percentage of time an activity/material was actually used (ranging from 100% of the time, 75%, 50%, 25%, to 0% of the time). The remaining items each had two response columns. the first response column was for teachers to indicate whether or not they had the survey item's concept/activity/etc. present in their classroom/school and whether or not they wanted the concept/activity. The second response column was a five-point Likert-type scale ranging from "extremely important" to "not important," regardless of whether or not the teacher believed the concept/activity was present in the classroom/school or whether or not they desired it. Finally, blank spaces were provided for teachers to elaborate on their responses as they desired. Instrument reliability was calculated to be $r = 0.87$ (test-retest) and the validity coefficient alpha was calculated to be 0.89. Cover letters that accompanied the survey were developed as well (see Appendix A).

Site Survey Instrument. A checklist was developed for the purpose of verifying written survey responses on site at selected respondents' schools. The checklist format followed the State Systemic Initiative core areas (one page corresponding with each of the 8 survey core areas). Three columns for site survey personnel responses were provided:

1. One for teachers
2. One for principals
3. One for limited student responses.

As with the written survey, blank spaces were provided for site survey personnel to elaborate on teacher/principal responses (see Appendix B).

Protocol

Each school site was visited once. A clear procedure was developed to schedule the visitation, make appointments with principals, teachers, and students. Trained observers who did the site visits were asked to observe artifacts of science instruction in classrooms and the school. Each site visitor prepared a written report immediately following his/her school visit. Written school site reports were analyzed and synthesized into this research study summary.

Personnel

Survey project personnel included two co-directors and eight university faculty, representing a total of nine universities geographically distributed throughout the State of Illinois. Criteria originally used in selecting personnel included their expertise in research projects; contacts with teachers; activity within state level professional organizations (science and mathematics); and their willingness to undergo training sessions and to coordinate and work with the co-directors. (See Appendix C for a listing of site survey

personnel.) Project co-directors provided each member of the school site survey team with copies of the written instruments and site visitation protocols and procedures.

Survey Administration

The original proposal design was to survey K-6 teachers from 242 Scientific Literacy Target Schools, then to follow up with on-site visitations to verify written survey responses at a subsample (30) of those schools.

A total of 242 survey packets were mailed to team lead teachers in the Target Schools in March, 1994. Each survey packet included the survey instrument, a cover letter, and a self-addressed stamped return envelope. The cover letter accompanying the survey specified a desired return date. Follow-up survey packets were mailed to those persons who did not return the initial survey by the specified date (up to three follow up letters, in some cases). The follow-up packet included an additional personalized letter which designated a new return date. Several telephone calls were made to elicit responses to the follow-up mailing as well. In total, 228 surveys were returned for a total response rate of 94.2%.

Scientific Literacy funds for Target Schools were disbursed through Educational Service Centers (ESC) to each participating school each year of Scientific Literacy Program funding. A list of Target Schools, their principals and lead science teachers was compiled from information obtained from each ESC's Scientific Literacy Project Specialist. This list was used for providing mailing addresses and telephone contacts for teachers and principals for the survey.

Site Survey Visitation personnel team members were each assigned ESCs in their respective regions. Team members selected at least two Target Schools in each ESC within their region for site visitations. Site survey team members completed the site survey checklist, wrote brief reports concerning their findings, and returned the checklists and reports by June, 1994 to the co-directors. The school site survey provided both qualitative and quantitative data which added both depth and breadth to this study and this report.

Data Analysis

Respondents' checked items were initially entered into the computer and analyzed to provide frequency data for each of the survey items. The Statistical Package for the Social Sciences was the program used to input and analyze data in this study. Later analysis compared teachers' written survey responses with their school site visitation responses (via dependent t-tests) for purposes of gauging believability of the results. Pearson correlations were conducted on responses by ESC region to determine whether certain responses were specific to any particular region of the state. Pearson correlations were also used to compare teacher and principal responses for schools receiving site visitations to determine the level of congruence between these two groups' perceptions of the status of science education in their schools. In addition, respondent data was compared to data of teacher responses on the written survey from 1993 via t-tests. (See Appendix D for raw data.)

FINDINGS

Individual survey item data have been clustered into the State Systemic Initiative (SSI) core areas for reporting purposes. Also included was the cluster of assessment items. For this reason, the results as reported below do not follow the survey items in numerical order. In addition, total

percentages may not total 100% due to rounding and invalid responses (omissions, mismarks, etc.) to some items on the survey, thus resulting in fewer than 228 responses.

Demographics

The survey items included in this area were items #1, 2, 3, 4, 5, 6, and 7 and asked about teaching science as a part of professional assignments, grade level(s) taught, average number of minutes per week devoted to science instruction, class size, years of teaching experience, undergraduate and graduate science courses taken, and undergraduate and graduate science methods courses taken.

The responding teachers for the 1993 K-6 general survey of science teaching and those for the 1994 Scientific Literacy Target Schools survey were very similar with respect to demographic variables examined. Care was taken so as not to re-survey teachers in 1994 who had been previously surveyed in 1993. No significant differences (t-test)between the two groups were found on any demographic variables except for the number of minutes they science taught per week and the number of graduate science methods courses taken.

When asked if they teach science as a part of their professional assignment, 99% of the 1994 survey teachers responded yes. The largest percentage of teachers responding (20.8%) taught 5th grade, followed closely by 4th grade (19.7%). The lowest percentage of teachers responding was 4.9%, which was for those teaching kindergarten (see Table 1 for further grade level breakdowns). The mean class size for the 1994 sample was 24 students (identical to the 1993 sample mean), with the largest percentage of teachers (%) reporting having between 21 and 29 students (see Table 3). The mean number of years of teaching experience for the 1994 sample was 16 years (again identical to the 1993 sample), with the largest percentages (15.9%) having 19 and 20 years of experience. The mean number of pure undergraduate science courses taken by the 1994 teacher sample was 4, with 72% having taken 2 or 3 courses. Just under ten percent (9.8%) reported having taken no such courses. With respect to graduate level science courses, fully 73.8% of the teachers had not taken these courses. Most teachers (47%) reported having taken an undergraduate science methods course, but 60.7% reported no such course in their graduate coursework. (See Table 5 for further breakdowns.)

The 1994 sample reported taking nearly one-half more graduate level science methods courses than their 1993 counterparts. (The 1993 sample mean was 0.707 courses compared to the 1994 sample mean of 1.273, $t = 3.686$, $p < 0.000$).

With respect to the number of minutes science is taught per week, the mean for the 1993 sample was 122.479 minutes (or 24.49 minutes per day) compared to a mean of 170.820 (34.16 minutes per day) for the 1994 sample. These differences were significant at the $p < 0.000$ level ($t = 5.511$). When extra minutes attributed to 7th and 8th grade teachers are factored out of the 1993 sample data, the mean number of minutes teaching science per day falls to 14.7 minutes, an even greater discrepancy between the two groups. (See Figure 1 for comparisons of time devoted to teaching science by grade level between 1993 and 1994 teacher samples.)

Curriculum

The survey items included in this core were #17, 18, 19, 20, 21, 22, 23, 24,

25, 34, and 77. Items 17, 18, 19, and 20 were rephrasings of the Illinois State Goals for Learning in Science (the breakdowns are shown in Table 6). State Goal Number One addresses process skills in science teaching, Goal Number Two addresses principles of scientific research, goal Number Three addresses social and/or environmental implications and limitations of science, and goal Number Four addresses the concepts and basic vocabulary of science. The remaining items in this core asked about intentional integrating of science with other subjects as part of the curriculum design, whether the teacher followed a written scope and sequence plan, whether the teacher was knowledgeable about the entire K-12 science curriculum in his/her district, inclusion of problem-solving activities in the curriculum, inclusion of science careers information in lessons, encouraging higher order thinking in students, and to which resources teachers first turn for help with their science teaching.

The Illinois State Goals items indicated that the majority of Target School teachers include the goals in their curricula and feel they are important: 88.5% for Goal I, 82.5% for Goal II, 81.4% for Goal III, and 82% for Goal IV. These percentages are comparable to, although slightly lower than, those reported by teachers in the 1993 sample.

Table 7 shows breakdowns of what Target School teachers believe is actually emphasized in the science curricula they teach. Just over 58 percent believe they integrate science with other subjects, and 67.7% claim to follow a written scope and sequence plan (compared to 76% of the 1993 sample). Most (61.7%) do not feel knowledgeable about the entire K-12 science curriculum in their districts. For each of these areas -- integration, scope and sequence, and K-12 curriculum knowledge -- large percentages of teachers perceive these areas to be important (78.7% for integration, 66.7% for scope and sequence, and 64% for K-12 curriculum knowledge). Focusing on problem-solving was reported in 60.1% of responses and was considered important in 77.1% of the cases. The inclusion of information on science careers was similarly present (67.2% so reported it), and only 8.8% felt it relatively unimportant. A high percentage (93.9%) indicated that their science curriculum promoted thinking over memorization, and they considered that important (88.5% thought so). As with the 1993 teacher sample, this last question on promoting thinking moreso than memorizing received the highest rating on its importance (73.2%) of all curriculum emphasis items.

The resources to which teachers turn most often for help in improving their science instruction are represented in Table 8 and in Graph A. Target School teachers' first choice was Educational Service Centers (43.7% so responded). In the 1993 teacher sample, textbooks and textbook companies were the first choice (71% so responded). Textbooks were the second most used source as reported by Target School teachers (39%). State agencies, university personnel, and Educational Service Regions received few responses as first choices. This category of questions elicited the largest number of written responses on the survey instrument. Teachers wrote 94 different sources (or 51.3%) which they consult for help compared to 226 (or 39.7%) from the 1993 sample.

A relatively large number of teacher comments were made concerning science curricula emphasizing process skills, techniques, methods, equipment, and available technology of science (State Goal I). Among the notable comments was that

Target School teachers who are directly involved with the scientific literacy projects deliberately teach science process skills. They noted also that other teachers might use science process skills, but its "sort of a build in act."

Other curriculum questions elicited a wide range of teacher comments. Some noted they had a general knowledge of the K-12 science curriculum, but lacked much specific knowledge about it. Kits were popular among many teachers who wrote comments. A few were concerned that kindergarten usually gets left behind or omitted altogether in science curriculum planning. Teachers from the upper grade ranges noted how well their students were now doing at science fairs.

Instructional Process

The survey items included in this core were #26, 33, 35, 40, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, and 69. These items inquired about science instruction addressing the needs of special student populations (bilingual, gifted, handicapped, etc.), linking classroom teaching to students' everyday lives beyond the classroom, student mastery of material, telling students lesson objectives, and use of a variety of approaches to science teaching (including hands-on activities, microcomputers, textbooks, kits, supplemental curricular materials, lecture, cooperative grouping, individualized learning, field trips, peer teaching, demonstrations, and extracurricular activities). The items were designed to gain insights into classrooms during science instruction as reported by teachers.

Table 9 shows teacher responses to items addressing needs of special students, use of application-level questions, mastery of topics, and telling students the lesson's learning objectives. The majority of Target School teachers believe *they presently have* or use the approaches referred to by the survey items. Application-level questions are employed by 93.4% of the teachers, and 86.3% reported telling students lesson objectives. Allowing students time to master topics was reported by 65.5% of the teachers, and specifically addressing the needs of special students was reported by 53.6% of the teachers. In all four areas, teachers felt the need as important (68.3% for attending to special populations, 87.9% for using application-level questions, 72.1% for allowing time for students to master topics, and 76.6% for telling students lesson objectives).

Regarding strategies used in science instruction, the responses from teachers were quite varied (see Table 10 and Graph B). When asked which strategies were utilized nearly 100% of the time, the use of cooperative learning emerged as the top choice, followed by laboratory/hands-on activities, supplemental curricular materials, and kits. (Since some teachers employ more than one strategy at a time, the percentages in any one column will add up to more than 100%.) Field trips are used sparingly by Target School teachers. Demonstrations, lecture, and individualized learning are used less frequently (25-50% of the time). Extracurriculars are used rarely if ever by the teachers. Surprisingly, 46.4% reported using microcomputers 0% of the time. This is in direct contrast to microcomputer use as reported by teachers from the 1993 sample (in which 65% reported using the machines).

Target School teachers' use of these strategies contrasts sharply with that of teachers in the 1993 sample. As noted in the foregoing paragraph, there is a substantial difference in microcomputer

use. Other contrasts can be found in the use of textbooks, cooperative learning, use of field trips, and extracurricular activities. What teachers in the 1993 sample seem to employ heavily is not used to a great extent by the Target School teachers, and vice versa.

Teacher comments written on the survey noted that they feel they are fighting an uphill battle at times since so much emphasis is placed on reading and language arts. Several noted how they were trying to integrate science with other subjects so that they could teach the amount of science they felt was necessary.

In regard to their own science instruction, some teachers wrote that they were trying to make students apply what they learned to everyday life, but that they could and should probably do more. They also noted that although mastery learning for students is the ideal, time and other factors seem too often to dictate that they move on. Some have attempted to integrate educational technology in their science teaching, but often lack enough equipment (computers, software, etc.) to do it effectively with their whole class. About half of the teachers' comments on field trips were positive. The other half essentially reflected the lack of district funds to allow for field trips to be taken.

Assessment

The survey items included in this core were items #70, 71, 72, 73, 74, 75, and 76 were intended to determine how teachers assess their students' learning of science. These items specifically inquired about the teacher's use of students' science products, performance items, interviews with students, performance checklists, paper-pencil tests and quizzes, student logs and journals, and questions at the end of chapters or units.

The picture which emerges (see Table 11 and Graph C) shows teachers utilized a variety of approaches in assessing their students. The types of assessment approaches used appears to be quite balanced overall. Student products, paper-pencil tests/quizzes, performance assessments and end-of chapter/unit questions seem to be the preferred approaches while student logs/journals and interviews with individual students are the least popular.

Teachers' written comments showed that some wanted to try more types of assessment than they were presently using. Some noted they often used more than one type of assessment in a single unit. Others stated they should try using certain types of assessment more.

Leadership

The survey items included in this core were #10, 11, 23, 27, 28, 29, 30, and 32. These items solicited information about leadership development such as teachers taking science or science methods courses within the past 3 years, teachers' participation in out-of-district science conventions or conferences, teachers' knowledge of the K-12 science curriculum; teachers' opportunities to provide input in science curriculum planning; recency of re-examination of the school district's goals, strategies, and materials; existence of a district science coordinator; presence of a "lead teacher" in science within the school building; and provision by the administration for teacher leave to attend professional meetings.

Data (see Table 12) indicate a dichotomy in the teacher population regarding taking university courses within the past three years. Nearly half (50.3%) reported taking such courses while half (49.7%) have not. Many teachers (58%) feel this is important to do. Several wrote that they

actively participated in workshops, but did not necessarily do so for credit.

Just under two thirds (63.9%) participate in out-of-district science conferences, and nearly the same percentage believe this to be important. A large majority (87.4%) reported being provided professional leave to attend conferences, with about as many reporting this to be important to them. Compared to the teachers from the 1993 sample, more Target School teachers have had recent university courses, participate in out-of-district conferences, and are provided professional leave to do so. Many more Target School teachers believe the first two things to be important than did teachers from the 1993 sample, whereas the 1993 teachers reported receiving more leave to attend conferences than was the case for the Target School teachers. Some Target School teachers reported that their administrators felt they were gone from the classroom too much (even for only two conferences per year) and eliminated attendance privileges.

With regard to curriculum planning, the same basic trends in teacher perceptions of importance were present (see Table 13). Information about the entire K-12 science curriculum was not known by 61.7% of the teachers (compared to 61% of the 1993 sample), yet 82.5% had input in their schools' science curriculum planning (compared to 82.%% of the 1993 sample). Some teachers wrote that such planning was done by committee, or that they alone were the committee, and sometimes that they had input but knew it wasn't really considered by the administration.

Only 59% of the Target School teachers reported having opportunities to re-examine the school goals in science at least once every five years (compared to 63% of the 1993 sample). This is interesting since many Target School programs specifically focused on reviewing school goals, clarifying (or developing) learner objectives and outcomes, and aligning curriculum to match these goals. Another interesting departure from 1993 teacher responses were those dealing with the school district having a science coordinator. In the 1993 sample, 45.7% reported having one, whereas only 21.9% of the Target School teachers reported having one. Teacher comments written on the surveys indicated that much of this type of responsibility seems informally to fall on the shoulders of one teacher, and that if a science coordinator was present in the past, he/she no longer was due to budget reductions.

Staff Effectiveness

The survey items included in this core were #8, 9, 10,. 23, and 31 and are shown in Table 14. These items asked about teachers' participation in staff development programs in the school district's adopted science program, in science teaching methodology, and in the teaching of elementary science (including the regularity with which such staff development is offered to teachers). Most teachers (82.5%) reported participation in staff development focusing on their district's adopted science program. Nearly the same percentage (83.6%) reported participating in staff development on science teaching methodologies. Written teacher comments indicated that most of these opportunities were provided through ESC and solely because of the presence of Scientific Literacy funds. Almost half (49.2%) reported no regularity in staff development focusing on the teaching of elementary science (compared to 60% of the 1993 teacher sample). In each case, over 80% of the teachers rated these activities as important.

School Environment

The school environment was heavily scrutinized (relative to other core areas) by the survey. The survey items included in this core were #36, 39, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, and 56. Support in the form of supplies, materials, equipment, and books was examined, as was classroom environment and teacher and administrator attitudes. Tables 15. 16,17, and 18; and Graphs D and E (parts 42B and 43B) show the data gathered concerning these survey items. Specifically, these items asked about the classroom showing evidence of ongoing science activities, teachers' use of a variety of instructional strategies and approaches in science teaching, sufficiency of district financial support for science instruction, availability of science materials and supplies, administrators' attitudes toward science, student discipline during science instruction, adequacy of science equipment, class size, availability of student science texts, presence of functioning sinks within classrooms, sufficient numbers of work tables/desks for science activities, and teachers' attitudes about teaching science (whether it was enjoyable, exciting, satisfying, rewarding, and comfortable).

Financial support for science teaching was viewed as being inadequate by 71.1% of the teachers (comparable to the 73% of the 1993 sample who responded similarly), yet was reported as being important by 85.8% of the respondents. Ready availability of supplies and materials was reported by 55.21% of the Target School teachers (compared to 42% of the 1993 sample), and 87.4% rated this as important. Just under two thirds (65.6%) reported being able to select support materials for their science instruction (the 1993 sample response was 70.5%). Adequate equipment was not present in 52% of the cases reported (down from the 61% reported by 1993 survey teachers). Most (84.7%) reported having adequate supplies of student science textbooks (a percentage slightly higher than the 79% of the 1993 teachers who similarly responded). The relative importance of these latter three items mirrored that of the first two items (see Table 15). Many teachers wrote comments that they either had to purchase much of their equipment and supplies out of their own resources, or obtained them through grants or by borrowing them from other teachers.

Most teachers (76.5%) reported their classrooms showed evidence of ongoing science activities (almost identical to the 77% from the 1993 sample). Class sizes were rated as appropriate for teaching science by 61.7% of the Target School teachers, a value similar to that from the 1993 teacher sample. The same pattern held true for sufficient numbers of tables/desks (59% for the Target School sample and 61% for the 1993 sample). Many written comments were made about large class sizes (30 students or more) and the inherent difficulties of doing hands-on science with so many and without other adult help, as well as safety concerns associated with too many students in a relatively small space.

Teachers from the 1993 sample appear to have more functioning sinks and faucets (52% did) than do Target School teachers (44.3% do). Some teachers wrote that they resorted to using the floor. Others wrote that they wished they had more electrical outlets. Each of these survey items was rated as being important by the teachers (78.7% for evidence of ongoing science activities, 84.1% on class size, 69.4% on sinks and faucets, and 77.6% on tables/desks). (See Table 16.)

In 1993, 87% of the responding

teachers said they used a variety of instructional approaches in their teaching of science. The 1994, 92.4% of the Target School teachers reported using a variety of approaches (see Table 17). Most (87.4%) feel this is important.

Administrators' attitudes were rated as being positive by 79.7% of the Target School teachers (compared to 83% of the 1993 sample teachers), and 83% noted student discipline was easily maintained when doing science activities (see Table 17). All three of these items elicited high percentages of "extremely important" responses from teachers. Some teachers noted that their principals' attitudes were positive, but attitudes of top administrators were often less than positive.

When asked to respond to a semantic differential scale on their feelings (attitudes) about teaching science, most respondents were very positive (see Table 18 and Graph D). Science teaching was very enjoyable to 72.7% of the Target School teachers (compared to 52% of the 1993 sample). Teaching science was very exciting to 62.3%, very satisfying to 59%, rewarding to 61.7%, and very comfortable to 46.4% of the Target School teachers (compared to 46%, 33%, 44%, and 35% of the 1993 sample teachers, respectively).

Financially, two notable aspects emerged. First, the vast majority of science programs were underfunded (see Table 15). Equipment and materials were lacking in sufficient quantity and availability for teachers to conduct hands-on science activities. Some teachers commented to site visitors that they were very concerned about their science programs once the Scientific Literacy funding ceased, since their districts simply did not have the money to continue operating the science programs as is currently being done. This pattern is very similar to that which emerged from the 1993 survey data. Data from the 1993 survey further indicated that the Chicago subdistricts were failing to support science in their schools moreso than was the case for other schools surveyed. This state of affairs is strikingly similar to that of the Target Schools as a group. A number of comments were received from Chicago Target School teachers concerning Scientific Literacy monies as well as other science monies. The gist of these comments was that the teachers were not seeing the money (or were only seeing very little) spent for science in their classrooms. Many teachers were spending money out of their own pockets for the supplies and materials to do science.

Parental Involvement

The survey item included in this core was #13, which asked whether parents were involved with the science program at the school. Of the Target School teachers who responded to this item, 31.7% indicated they had parental involvement with science education in their school while 50.3% indicated they did not (18% did not respond to this item) -- comparable to responses from the 1993 survey teachers. As an interesting contrast, the teachers feel that parental involvement is important (25.1% feel it is extremely important and 30.6% feel it is very important).

School-Community Relations

The survey items included in this core were #13, 14, 16, and 37. The focus of these items was to ascertain whether the business community is involved with science education in the teachers' schools; whether the teachers contribute to community science organizations; the degree to which the community provides science supplies, talent, and equipment for the

school; and the extent to which people from the community are utilized for class or help with student research projects.

The items in this core revealed that 82% of the teachers do not perceive of the existence of business contributions in helping their schools' science programs (up from 74% of the 1993 teacher sample). Aside from taxes, 67.2% of the teachers do not believe their community provides supplies, talent, or equipment for their school science programs (the same as for the 1993 teacher sample). Three fourths of the sample also do not believe people from the community are utilized to help with science class or science projects. Just over half (54.1%) of the Target School teachers reported contributing to community science-related organizations. As in the 1993 data, there appears to be a "one way street" with respect to science education. The community receives teacher contributions in science but the schools receive little in return from their communities. The sample teachers believed each of these four items to be important. However, of the four, the one which received the lowest ratings of importance was teachers contributing to community organizations (where most think it is somewhat important or are neutral about it). Many of the Target School teachers reported they are simply too pressed for time to contribute more to community organizations. See Table 19 for further breakdowns of this data.

Site Survey Visitation Summary

Ten faculty from eight universities geographically dispersed throughout Illinois served as site survey personnel. Responsibilities of these individuals included selecting, usually at random, two Scientific Literacy Target Schools from each Educational Service Center in their areas. This translated into most site survey team members visiting at three to four schools (for a total of 30 visited schools). The visited schools comprised a subsample of 16.4% of the Target Schools (in 1993, the visited school subsample was 14.7% of the survey sample). Every team member made his/her own arrangements to visit Scientific Literacy team "lead teachers" in selected schools, completed a site survey checklist during the site visitations, observed and recorded characteristics of visited schools, and wrote a follow-up site visit report. The site visitation checklists and written reports were then submitted to the project directors.

As a check for consistency between each site visitor's ratings, inter-rater reliabilities for each survey item were determined by using Kendall's coefficient of concordance. Reliability coefficients were moderate to high, ranging from a low of $r = 0.621$ to a high of $r = 0.964$ (the 1993 reliability range was 0.552 to 0.810).

Pearson correlations were calculated for each survey item by geographic region of the respondents. No significant differences were found to exist between the Target Schools. Target School teachers in each geographic region of the state are generally consistent with one another concerning their views of the status of science education within their schools and their perceived needs regarding science instruction. This finding is consistent with that from the 1993 survey as well.

Teacher responses were compared to principal responses via Pearson correlations on 59 survey items. As with the 1993 survey sample, correlations were minimal, with many being negative. Of the 59 items compared from the Target School sample, 68% were negative (compared to 91% for the 1993 sample). Although much different from the 1993 data, these results

still indicate that the perceptions of teachers and principals do not match well. This has been attributed to lack of communication, top-down orientations in decision-making processes, or teachers and/or principals who make little genuine effort to deal with science within the classroom/school. This latter reason is not likely with respect to the Target Schools since the teachers visited were the team leaders for the schools' Scientific Literacy projects. Two other explanations may be plausible here. First, even though more principals were deeply involved with the Target Schools than was the case in the 1993 sample, there are still those administrators who prefer to allow projects to go on as long as the activities don't begin to interfere with the their schedules or routines. However, most principals interviewed by the site personnel appeared to be genuinely interested in the science program. Second, principals tend have a more global (or school-wide) view of what occurs within their buildings, in contrast to teachers' views which tend to be more isolated and room-centered.

For purposes of further analysis, data from the site visit interviews were treated as posttest data and compared to written survey (pretest) data. This was possible since site survey checklists were generated directly from the written survey and items on both correlated very closely with one another. Dependent t-tests were conducted on 51 survey item responses. Fully 90.2% of the items showed no significant differences between pretest and posttest responses of the teachers. More discussion on these results will be found in the following section. Overall, data obtained during site visitations corroborated teacher responses on the written survey.

While there is some variability in the data gathered at school sites, there are some consistent patterns that appear from these schools. Much of this information seems to be directly related to the Educational Service Center Target Schools projects. Overall, principal support is positive and seems to be directly related to successful local school projects. In the few cases where the principals appeared indifferent or uninvolved in the local project, there was concern on the part of teachers for the fate of the scientific literacy program when the state funding ended. The principals and teachers emphasized the importance of the local ESC as a change agent in the improvement of science programs. They noted that the ESC's were responsible for introducing teachers to a wide range of new curricula, laserdisc material, computer and CD ROM technology, and hands-on laboratory activities. There continues to be a good deal of pressure on teachers to emphasize language arts, reading and arithmetic over the teaching of science in the elementary classroom. However, many teachers indicated that they were developing theme units and integrated activities that included science with these other disciplines.

Textbooks remain the primary delivery system in the Target Schools, but there is evidence that teachers are shifting toward using texts more as resources to kit driven programs. Others are supplementing the text materials with teacher-developed kits or commercial kits as well as utilizing laserdisc programs and computer resources. Most of the Target Schools surveyed also indicated that teachers were playing an active role in developing the local curriculum and school scope and sequence plans.

Teachers and principals indicated that more was being done to address the assessment needs of students through the creation and adoption of alternative

assessment methods including portfolios, performance observations and performance tasks. One major concern was that the need for these assessments seemed to be state driven rather than focusing on student need. This concern is notable since it is identical to that expressed by the 1993 teacher and principals.

Financially, most districts report a need for more resources in the science area. Especially with regard to support for the laboratory programs that are being promoted through the Target Schools initiative. Many principals and teachers expressed the fear that when the literacy funding disappears the motivation to support programs financially will also disappear. The funding for the purchase of consumable materials is a related area that needs to be addressed. Many teachers indicated that maintaining support for laboratory activity materials was difficult. A notable exception to this problem was reported in one district where all families are assessed a two-dollar annual science material supply fee. Apparently, parent support was strong for this expenditure due to its relationship to a "good" science program.

Most target school teachers were aware of and used funding for attending professional meetings such as the annual Illinois Science Teachers Association and Illinois Council of Teachers of Mathematics meetings. Nearly all of the principals and teachers interviewed showed strong support for the series of professional workshops sponsored through the Target Schools program.

Most of the schools surveyed were distinguished by having a principal who showed adequate to good support for science. Many principals were strong advocates of science programming, especially where teachers were using the materials with other subject areas. Teachers in the Target Schools are, for the most part, involved in writing curriculum, developing district learning outcomes and the curriculum scope and sequence.

Science facilities in many of the target schools are woefully inadequate to support hands-on laboratory activities. Schools reported the lack of running water in the classroom, with no tables for the students to conduct their experiments. Many of these classrooms are still furnished with the sloping individual desktops. An additional problem was the lack of storage areas for the equipment and supplies. Large class size was also cited as presenting a barrier to conducting a good hands-on science program.

Some schools visited in the Target School program show little impact from the Scientific Literacy program, while many of these schools include designated science rooms, materials in the classroom, outdoor science areas, and other indicators that science is an important part of the schools' curricula. An important element in almost all of the visits was the obvious enthusiasm of the teachers involved for the Target School program and the new science teaching ideas that they were applying in their teaching.

The greatest number of problems were reported by site survey team members in the Chicago Public Schools. It is noted that there is a dire need for re-training of teachers, severe science supply problems, the need for more hands-on activities, and a need for books.

Pre-Post School Site Differences

Unlike the 1993 survey, most principals and teachers were very open about the school site visits. Their answers to questions appeared to be more honest and congruent with written survey responses

than was the case overall with the 1993 site visitations. Few stock responses were given during the 1994 site visitations, and most responses were clearly credible and substantive. There were a few instances in which principals were not available to visit with the site personnel at the time of the initial visits, but it is notable that these principals contacted the site personnel to arrange for completing the surveys.

The survey researchers believed some pretest-posttest response differences in 1993 may have arisen due to interpretive changes for specific survey questions. An example cited was that some teachers did not know what "S-T-S" meant, and may have likely responded one way on the written survey and in yet another way during site visitation when "S-T-S" could be explained. This problem may have existed for the 1994 Target School survey as well, yet to a lesser extent. To compensate for such problems, a significance level of $p < .001$ was established for the t-testing.

As noted in the previous section, of the 51 questions for which pre-post comparisons were made via dependent t-tests, 90.2% (46) showed no significant differences. This would indicate that interpretive difficulties were at a minimum during the 1994 survey.

The five items for which significant differences were found were #12, 13, 24, 26, and 38. Item #12 addressed the involvement of parents in the school's science program. Item #13 examined business/community involvement with the school's science program. The inclusion of problem-solving activities in the science curriculum was the focus of item #24 while addressing the needs of special student populations was the focus of item #26. Item #38 looked at teachers' handling of hazardous materials in the classroom.

In each of these cases, posttest means were lower than pretest means, indicating that teachers have it more than they previously thought. For item #12, the pretest mean was 2.066 while the posttest mean was 1.379. For #13 the pretest was 2.224 and posttest was 1.655. The pretest mean for item #24 was 1.672 and the posttest mean was 1.034. Item #26's pretest mean was 1.792 and the posttest mean was 1.207. Those for item #38 were 1.984 and 1.103, respectively. With regard to handling hazardous materials in the classroom (item #38), most teachers reported that they did not use such materials in their teaching. However, during site interviews, teachers became aware that common substances such as ammonia are often considered hazardous. Once this awareness was established, many teachers agreed that they did indeed handle such substances, but that they and their students did so with care. This change in perspective likely accounts for the pre-post differences for this item.

Comparison to the 1993 Statewide K-6 Science Survey

In 1993, an identical survey was conducted on K-6 science teaching throughout the state in general. This same survey was repeated in 1994 with only Scientific Literacy Target Schools. Comparisons between the responses of the two groups were made specifically in an attempt to see what impact, if any, Scientific Literacy funding has had on Target Schools. Comparisons were made on each item via independent t-tests since the surveys and procedures employed for both were identical.

In both the 1993 and 1994 surveys, teachers were asked to read 44 statements and respond as to whether they presently "had" the item referred to in the statement (rated as a "1"), "wanted" the item (rated

as a "2"), both "had and wanted" (rated as a "3"), or "neither had nor wanted" the item (rated as a "4"). In 96% (42) of the cases, the Target School teachers (1994 survey teachers) responded that they "had" the item moreso than did the 1993 teacher respondents. The two statements for which this trend failed to prevail were #14 ("I contribute to community organizations such as nature centers/trails, parks, zoos, museums, etc.") and #29 ("Our district has a science coordinator.").

Of the survey 44 items referred to in the above paragraph, 45.5% (20) showed significant differences between the two survey groups' responses as determined by independent t-tests. Statistically significant differences were found between groups on items #8, 9, 10, 11, 17, 18, 19, 20, 23, 26, 27, 30, 31, 32, 33, 39, 42, 43, 47, and 49 (see Tables 20a and 20b).

Teachers were asked to respond to the same 44 survey items in a second manner, this time by indicating the degree of importance they placed on each item. For this, teachers responded on a five-point scale ranging from "Extremely Important" (rated a 5) to "Not Important" (rated a 1). In every case except five, 1994 Target School teachers' means were higher than their 1993 counterparts' means. For the five means in which the trend was reversed, the differences were small (ranging from 0.001 to 0.041 points).

When 1994 data were compared to 1993 data via independent t-tests, significant differences were found to exist on 38.63% (17) of the items. The significant differences were found for items #9, 10, 11, 12, 17, 18, 19, 20, 23, 24, 27, 31, 32, 33, 36, 42, and 43 (see Tables 21a and 21b).

Similarly, 1993 and 1994 survey responses were compared for items 52-56, which indicated the teachers' perceived levels of stress and comfort in their teaching of science. The 1994 Target School teachers means were significantly higher (t-test) than the 1993 sample for each of these items (see Table 22). The reader should note that for the scoring of these items, the lower the mean the higher the level of comfort, etc. since the semantic differential scale used had values reversed from those used on previous items. Overall, the 1994 Target School teachers expressed higher levels of enjoyment, more excitement, more satisfaction, more rewarding feelings, and higher levels of comfort than did the responding teachers in 1993.

In both years, teachers were asked to rate their frequency of use of a variety of classroom teaching strategies. Forced response choices ranging from "100% of the Time/Very Frequent" (rated a 5) to 0% of the Time/Not Used" (rated a 1) were used. Eight of the thirteen items were found to be significantly different between the two groups. The means for the 1994 Target School teachers were higher than were those from the 1993 sample on half of these items (item means for #59, 63, 66, and 68 were lower for the 1994 sample). Overall, compared to the 1993 sample, the Target School teachers use more laboratory/hands-on activities, employ microcomputers with their students more, make more use of commercially and district/teacher prepared kits, and use more supplemental curricular materials. Conversely, the 1994 sample relies less on textbooks, lecture, field trips, and demonstrations than did the 1993 sample. (See Table 23.)

With respect to assessment used in their teaching of science, teachers were asked to respond to survey items #70-76. Again, forced response choices ranging from

"100% of the Time/Very Frequent" (rated a 5) to 0% of the Time/Not Used" (rated a 1) were used for these items. Significant differences (t-test) on 3 of the 7 items were found. Compared to the 1993 sample, the 1994 Target School teachers make more use of science products students produce ($t = 4.682$, $p < 0.000$), performance assessment items ($t = 3.251$, $p < 0.001$), and performance checklists ($t = 3.469$, $p < 0.001$). For the remaining 4 items on assessment for which significant differences were not found, the Target School teachers means were higher on the use of individual interviews with students (1993 mean = 2.375, 1994 mean = 2.426), paper and pencil quizzes and tests (1993 mean = 3.319, 1994 mean = 3.322), and the use of student journals and logs (1993 mean = 2.580, 1994 mean = 2.683). The 1994 Target School teachers rely less on questions at the end of chapters and units (mean = 3.126) than did teachers in the 1993 sample (mean = 3.305).

When asked to rank order the resources to which they most often turned for help (survey item #77), significant differences between the 1993 and 1994 samples were found (t-test) for 3 of the 6 resources. Target school teachers turn to the textbook less than did the 1993 teachers and turned more to Educational Service Regions (Regional superintendents) and University personnel (science/science education faculty). Although not statistically significant, Target School teachers also made more use of Educational Service Centers, various state agencies, and "other" resources than was the case with the 1993 teacher sample. (See Table 24). Since much (in some cases all) of the Scientific Literacy activity to which teachers in the state were exposed originated through their Educational Service Centers, it is interesting to note that the means for the ESCs were not significantly different between the 1993 and 1994 teacher samples. This possibly speaks to the ESCs' collective efforts to provide service to all (or most) schools within their regions regardless of the schools' designation as "Scientific Literacy Target Schools" or lack thereof.

Comparisons With Other Prior K-6 Studies

Fitch and Fisher (1979) reported data from a K-6 survey the conducted in Illinois during the 1975-76 academic year. Later, Morey (1990) published results of a similar Illinois survey conducted in 1987. Some similarities and differences between the 1994 study and these earlier two studies.

The earlier surveys revealed teachers used textbooks predominantly as compared to other approaches. In 1975, 73% of the teachers relied almost exclusively on textbooks. Since 1975, the number of instances where textbooks alone were used has apparently decreased. The 1994 data seem to indicate that teachers in the Target Schools are moving away from reliance on textbooks and are beginning to use them more as secondary resources. Regarding statewide data on K-6 science teaching, for the first time since 1975 textbooks were not the number one resource utilized by teachers.

Teachers' use of kits has been an up-and-down venture since 1975. In 1975, 31% of the teachers reported using kit-only approaches in their teaching. This dropped to 12% in 1987 and rose again to 38% in the 1993 survey. Target School teachers tend to be less likely to rely on kits than their colleagues reported in 1993. Kit-only approaches were reported by only 14.8% of Target School teachers, although kits used in conjunction with other teaching

strategies seemed to be relatively common.

Lack of facilities, equipment, and materials were cited as a detriment to teaching science in 1975. These, along with added funding difficulties, were cited again in 1987 and 1993. In 1993, 64% of the teachers cited insufficient financial support for teaching science, 53% cited lack of readily available materials, and 56% cited inadequate science equipment. Insufficient funding was reported by 33.3% of the Target School Teachers in 1994 even though they had received extra funds specifically allocated for science. Adequate materials was reported to be a problem by 51.9% of Target School teachers, and supply availability was a problem for 56.8%. Science education seems to remain underfunded.

Science preparation for teachers had not improved significantly between 1975 and 1993. In 1975, an inadequate science background was cited as the primary deterrent for teachers to teach science. By 1993, 72% took fewer than 6 hours of pure science and 74% took fewer than 6 hours of science methods courses. There appears to be little difference between the teachers in the 1993 survey and the Target School teachers in the 1994 survey. The conclusion remains the same: elementary school teachers are not taking the National Science Teacher Association recommended minimum number of science content courses, and relatively few take graduate level science methods courses. Each teacher in preparation should be required to take a physics, chemistry, biology, and geology course. These courses, if taught in an activity-based, laboratory approach rather than a pure lecture format, could provide a solid foundation for teaching science in elementary schools with confidence and competence in the disciplines. Such approaches are seldom modeled in courses offered through science departments at colleges and universities, and movements to require elementary teachers to take these courses without fundamental changes in the way the courses are delivered are unlikely to contribute to solving this problem. Graduate level methods courses should also be emphasized since undergraduate methods courses are limited in what they can cover and preservice teachers lack the experience and maturity to more fully accommodate and assimilate important concepts and theoretical bases with respect to the effective teaching of science.

Time devoted to the teaching of science is also a factor relevant to helping students become scientifically literate. In 1975, the mean number of minutes devoted daily to science instruction was 23.4. In 1993, factoring out time data from grades 7 and 8, the mean number of minutes per day dropped to 14.7. In contrast, the Target School teachers in 1994 spend an average of 34.16 minutes per day (refer to Figure 1). Clearly, Scientific Literacy programs and funding has radically altered the amount of time devoted to science teaching in Target Schools.

Implications

In general, science teaching in the Target Schools is much improved over that in the State's elementary schools in general. Considering the monolithic nature of education today, the changes evident in the Target Schools (as compared to elementary schools in general) are significant after only a few years of receiving additional funding for science. Yet more remains to be done. From this study and the results of the 1993 survey, a number of implications emerge:

1. One of the major problems continues to be lack of sufficient financial support for science instruction, and even Target

School teachers are concerned about the consequences of having their Scientific Literacy funding end.

2. Whereas science is not highly valued by elementary school teachers as a whole, it is apparent this is not the case for the Target School teachers. Target School teachers are teaching more science to their students than has been the case since the mid-1970s.

3. Science instruction in elementary schools throughout the state has typically been characterized as dull, lifeless, and boring. In the Target Schools, science instruction is vibrant and attempts to make connections to the real world outside the classroom.

4. In the State's K-6 schools in general, the textbook has been and continues to be THE science curriculum. Science is not a verb, but is taught as a noun -- a thing to be learned. In contrast, science in the Target Schools is more of a verb to both teachers and students. Textbooks, although still heavily used in many Target Schools, no longer constitute the entire curriculum.

5. Elementary school teachers are largely prepared to teach biological sciences but express discomfort with physical, chemical, and earth sciences. As a result, the study of the life sciences tends to be stressed in elementary classrooms while the physical sciences are largely ignored. Although this trend persists within the Target Schools, teachers there have recognized this limited presentation and have made attempts to begin plugging these gaps.

6. In the 1993 survey, teachers reported staff development and teacher inservice education in science to be an abomination. Few opportunities exist for studying activity-based science instructional strategies sufficient to raise the incidence and quality of instruction in science for young children. When those opportunities do exist, they are often of poor quality. The Target School data reveal that the quality of staff development efforts has improved, as has the quantity. However, Target School teachers continue to recognize the need for and request further staff development. Evidently, the more the teachers know, the more they realize what they need.

7. The infrastructure for science teaching is still in poor condition. Teachers' wish lists from the 1993 survey included such items as running water, sinks, electrical outlets, storage space, etc., moreso than computers, CD ROM, video disks, etc. These lists included the very basics for science instruction. Few of these concerns have been alleviated in Target Schools. The lack of sinks, outlets, and storage space remains a problem. Educational technology (computers, CD ROM, etc.) has found its way into many Target School classrooms, yet the basics remain unobtainable.

8. Principals and teachers do not see eye to eye on many issues and needs with respect to science education. The 1993 survey revealed that teachers' and principals' perspectives differed on over 9 out of every 10 issues/needs. Through Scientific Literacy projects, this perceptual gap has narrowed considerably (differences were present in fewer than 7 out of 10 issues/needs identified). The most effective schools are those in which teachers and administrators pull together in the same direction as a team. Even in the Target Schools, this is not happening at a very efficient level.

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9. Schools and their communities (particularly the businesses in those communities) seldomly experience sustained, high quality working relationships with one another. Although schools should not necessarily alter their structures and procedures to fit business models, it is important that both schools and businesses consistently communicate and work together so that students will be more than adequately prepared to enter the working world after compulsory schooling ends.
10. Active parental involvement in schools is vital for the support base necessary for schools to improve their science instruction. In the 1993 survey, over 51% of the respondents indicated this linkage to be very or extremely important. Similarly, 55.7% of the 1994 Target School teachers felt the same. However, only 31.7% of the Target School teachers indicated they had parental involvement in science education.

Recommendations

If we are truly serious about becoming world class in science and technology as a state and nation, we must listen carefully to what the teachers in our schools are telling us. They are the professionals in daily contact with the students, and it is they who see firsthand the needs of those students. More decision making involving teacher input should be included rather than having decisions made in isolation from the classroom and school. Based on the results of this survey, feedback from teachers, and direct observations by the survey project staff, the following presents an incomplete list of recommendations to improve the status of science education in Illinois schools:

1. Much more financial support for science is necessary. Elementary children are in a concrete learning stage and must be provided with concrete learning materials which are maturationally appropriate. At the same time, teachers must be taught how to best use such materials. Teachers should not routinely be expected to purchase supplies and materials with their own funds. (Few businesses use this type of practice.) From the results of this study, it is obvious that Scientific Literacy monies for Target Schools have made demonstrable and positive differences in science education. Such funding levels should be maintained if science education in these schools is to continue to improve (or even hold steady). The gains that have been made in Target Schools may largely be lost if current funding levels decline precipitously. To generalize further, if our goals include making all Illinois students scientifically literate, then all schools in the state should receive funding for science at levels on a par with the Target Schools.
2. Science thinking for successful living in the 21st century and beyond is basic. Science is absolutely as basic as learning to read, write, and compute. Science instruction must be given equal billing on the elementary school marquee along with reading, writing, and arithmetic. Science should be elevated to a basic, core, required subject in elementary schools. Each child must be offered a "hands on, minds on" science lesson each school day as a basic offering. The efforts to address this have started in the Target Schools, but vigilance is necessary lest schools fall back to the

same old routines.

3. Adequate funding is needed to provide for more instructional options for teaching children science. Besides the arsenal of CD ROMs, bar code readers, computers, etc. obtained via Scientific Literacy funding, other materials are needed, and easy access to them (by teachers) is equally important. There is no substitute for children engaging in "hands-on" explorations with concrete instructional materials: plastic vials, magnifying lenses, rock and mineral specimens, etc., etc. These items cost money, and the requirements for a single classroom often outstrip the science budgets for entire buildings. Not providing these items for our children will certainly cost society more in the future. Scientific Literacy monies have helped begin to meet these needs in Target Schools, but much remains underfunded.

4. Elementary teacher certification must require preparing teachers to take a highly activity-based series of science courses including both life and physical sciences as a general education requirement. Organizations such as the National Science Teachers Association recommend no fewer than 12 semester hours of such coursework. In addition, at least one undergraduate science methods course must be required, and for permanent teacher certification (or for certification renewal), a graduate level science methods course must be required of all elementary teachers. Periodic updating by completing science and science methods courses should also be considered as a requirement for continued certification.

5. University and College level science courses which are taken by elementary teachers (preservice and inservice alike) must be designed to address the needs and learning styles of the teachers. This includes courses having many hands-on components along with good "minds-on" linkages. Courses originally and specifically designed as large lectures with additional laboratory sessions are primarily for preparing professional scientists rather than preparing teachers. These courses should also have strong connections with science methods courses at both undergraduate and graduate levels so that teachers can learn more effectively how to teach the content they learn in the pure science courses.

6. The State of Illinois and school districts must offer high quality science teacher inservice education, and do so on a regular and frequent basis. Our children deserve better prepared science teachers using better science instructional strategies and materials each and every day. The key variable in high quality science instruction is a well prepared, well equipped, energetic teacher. Teachers need paid summer months to study and/or attend evening and weekend classes, to have paid days to visit other classes to see "sciencing" in action, and to receive financial help to attend conferences such as the Illinois Science Teachers Association and/or National Science Teachers Association annual and regional meetings to gain further insights in sciencing. To some degree, Scientific Literacy monies have worked in conjunction with Eisenhower Title II monies to allow Target School teachers to do some of these things. However, there remains great variability in teacher access to these opportunities and funds.

7. The State of Illinois must educate principals and other administrators in

the latest appropriate science teaching methodologies. These efforts should not be directed solely toward principals since decisions affecting principals and their teachers are often made by other administrators. Large numbers of administrators need to be updated and upgraded in science instructional methods and strategies. One avenue for this could be the Administrator's Academy concept, which needs to be expanded to include greater numbers of administrators. These administrator staff development opportunities must parallel those teachers are expected to attend. As long as teachers' staff development progresses along one path and administrators' along another, the infusion and implementation of scientifically literate programs and curricula will continue to be somewhat disjointed and slow. Concerted efforts must be made at the state level to insure administrators and teachers are pulling together. In addition, principals need to learn to share decision making with their equal partners -- the classroom teachers. The top down hierarchies are totally inappropriate. Decisions, and the time to plan and make them, must be shared.

8. Means of upgrading and improving the infrastructure of our schools should be found. Every classroom should have the basics for teaching science, including such things as functional sinks, electrical outlets, and adequate storage space.

9. Strategies for encouraging and nurturing business and community involvement with science instruction in our schools must be developed and implemented as a regular part of the science program rather than as an aside. This must go beyond simply contributing to the tax base. More must be done than providing the occasional "prizes for science fairs" type of contribution. These efforts are not likely to occur, or be long sustained if they occur, if left only to the schools do. Viable, productive school-community/business relationships are rare, and school personnel probably do not know how to proceed in securing such linkages. The same may be likely from a business viewpoint. Much needs to be done in this area from both directions without one unduly imposing itself on the other. Both should understand that such relationships extend beyond the exchange of monies alone.

10. If parents are more closely involved with schools' science education efforts, they will be more likely to understand what their children are learning and why that is important to learn. They will be more supportive of their schools and teachers' efforts. Specific programs should be developed to include parents in the planning and implementation of hands-on science. More efforts should be forthcoming from schools to insure parental involvement is continual and sustained, and not just limited to once a semester events and newsletter communications. Schools need to find ways to help parents see how they can pragmatically be involved. Similarly, parents must understand that they must actively contribute to and support their schools' science programs, and that their efforts do make a difference. Both school personnel and parents should be educated in ways to establish and enhance school-parent partnerships. Such efforts should be well publicized, explicit and continual in nature.

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Overall, teachers, administrators, colleges and universities, state agencies (including the legislature), businesses, and communities must work in a coordinated and team effort if significant changes toward scientific literacy are to occur in our schools. One or two segments of the equation, working alone, is not sufficient. The efforts directed through the Scientific Literacy Target Schools have demonstrated that much can be accomplished when all parts of the equation are in synchronization. The task which lies ahead is to expand these efforts to other schools without neglecting the Target Schools where so much progress has thus far occurred, and to do so consistently for the long term. There are no shortcuts, not short term solutions. Such efforts and their consequential changes take time, effort, and money.

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TABLES

Table 1

Grade Level Taught

Level	f	%
K	9	4.9
1	20	10.9
2	23	12.6
3	29	15.8
4	36	19.7
5	38	20.8
6	28	15.3

n = 183

Table 2

Number of Minutes Per Week Science is Taught

# Minutes	f	%
0	4	2.2
1- 35	0	0.0
36- 70	18	9.8
71-105	28	15.3
106-140	20	10.7
141-175	33	17.9
176-210	42	22.9
211-245	16	8.7
211-245	16	8.7
246-280	8	4.2
Over 280	14	7.3

n = 183

Table 3

Class Sizes Taught

Class Size	f	%
1- 5	2	1.1
6-10	3	1.5
11-15	11	5.9
16-20	25	13.6
21-25	71	38.8
26-30	53	29.0
31-35	13	7.0
36-40	3	1.6
Over 40	2	1.0

n = 183

Table 4

Years of Teaching Experience

Experience (Years)	f	%
Less Than 1	2	1.1
1- 5	21	11.4
6-10	32	17.5
11-15	31	17.0
16-20	37	20.1
21-25	40	21.9
26-30	17	9.2
31-35	1	0.5
36-40	1	0.5
Over 40	1	0.5

n = 183

Table 5

Courses Taken

	Pure Science		Science Methods	
# Courses	f	%	f	%
0	18	9.8	57	31.1
1	13	7.1	86	47.0
2	39	21.3	24	13.1
3	34	18.6	10	5.5
4	24	13.1	3	1.6
5	14	7.7	1	0.5
6	15	8.2	1	0.5
7	3	1.6	1	0.5
	n = 183		n = 183	

Table 6

Emphases in the Curriculum: State Goals for Learning in Science
(% Respondents)

	Process Skills	Principles of Scientific Research	Social and/or Environmental Implications Limitations	Concepts & Basic Vocabulary
STATUS:				
Present	78.2	72.1	65.6	83.6
Not Present	21.8	27.9	34.4	16.4
RATING:				
Extremely Important	73.2	55.2	47.5	51.9
Somewhat Important	15.3	27.3	33.9	30.1
Neutral	10.9	16.4	17.5	18.0
Somewhat Unimportant	0.5	0.5	0.5	0.0
Unimportant	0.0	0.5	0.5	0.0
	n = 183	n = 183	n = 183	n = 183

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Table 7

Emphases in the Curriculum
(% Respondents)

	Science is Integrated Other Subjects	Teacher Follows Written Scope and Sequence Plan	Teacher is Knowledgeable About K-12 Science Curriculum
STATUS:			
Present	58.4	67.7	38.3
Not Present	41.6	32.3	61.7
RATING:			
Extremely Important	56.8	36.1	27.9
Somewhat Important	21.9	30.6	36.1
Neutral	19.7	26.8	27.9
Somewhat Unimportant	1.1	3.3	7.1
Unimportant	0.5	3.3	1.1

	Focus is on Problem-Solving Activities	Includes Information on Science Careers	Promotes Thinking Moreso Than Memorizing
STATUS:			
Present	60.1	67.2	93.9
Not Present	39.9	32.8	6.1
RATING:			
Extremely Important	45.4	23.5	73.2
Somewhat Important	31.7	32.8	15.3
Neutral	21.3	35.0	11.5
Somewhat Unimportant	1.6	6.6	0.0
Unimportant	0.0	2.2	0.0

n = 183

Table 8

Help Resources Most Used Or Sought By Teachers

(% Respondents)

Choice	Textbooks or Textbook Companies	ESC	ESR	University Personnel	State Agencies
1st	39.0	43.7	2.7	3.3	13.7
2nd	21.3	33.9	4.9	10.9	15.8
3rd	12.6	12.0	16.9	13.7	6.6
4th	7.7	2.2	10.4	12.6	4.9
5th	1.6	0.5	12.6	13.1	0.0
6th	16.9	7.7	52.4	46.5	59.0

n = 183

Table 9

Science Instructional Process
(% Respondents)

	Addresses Needs of Special Students	Teacher Uses Application Level Questions	Time Allowed for Mastery of Topics	Students Are Told Objectives of Lessons
STATUS:				
Present	53.6	93.4	65.5	86.3
Not Present	46.4	6.6	34.5	13.7
RATING:				
Extremely Important	38.8	69.9	41.0	53.6
Somewhat Important	29.5	18.0	31.1	23.0
Neutral	28.4	12.0	24.6	19.7
Somewhat Unimportant	3.3	0.0	2.7	3.3
Unimportant	0.0	0.0	0.5	0.5
	n = 183	n = 183	n = 183	n = 183

Table 10

Strategies Used in Science Instruction
(% Respondents)

	100% of Time	75% of Time	50% of Time	25% of Time	0% of Time
Laboratory or Hands-On Activities	14.8	52.5	26.2	6.6	0.0
Microcomputers	1.6	7.7	17.5	26.8	46.4
Textbooks	10.4	30.1	28.4	16.4	14.8
Commercial Kits	10.4	23.5	20.2	18.0	27.9
District or Teacher Kits	14.8	33.3	21.9	16.9	13.1
Supplemental Curricular Materials	14.8	29.0	22.4	21.3	12.6
Lecture	2.7	15.3	37.7	32.2	12.0
Cooperative Learning	19.1	52.5	21.3	5.5	1.6
Individualized Learning	6.6	21.9	35.5	27.3	8.7
Field Trips	2.7	12.6	18.0	50.3	16.4
Peer Teaching	3.8	23.0	24.0	32.2	16.9
Demonstrations	12.6	26.8	43.2	16.9	0.5
Extracurriculars	3.3	6.6	13.7	27.9	48.6

n = 183

Table 11

Assessment Used in Science Teaching

Type of Assessment	% Of Time Used	f	% Respondents	Type of Assessment	% Of Time Used	f	% Respondents
Student Products	100	25	13.7	Paper/Pencil Tests/Quizes	100	24	13.1
	75	57	31.1		75	71	38.8
	50	58	31.7		50	50	27.3
	25	35	19.1		25	16	8.7
	0	8	4.4		0	22	12.0
n = 183				n = 183			
Performance Assessment	100	28	15.3	Student Logs or Journals	100	16	8.7
	75	58	31.7		75	36	19.7
	50	55	30.1		50	48	26.2
	25	30	16.4		25	40	21.9
	0	12	6.6		0	43	23.5
n = 183				n = 183			
Interviews w/Students	100	15	8.2	End of Unit or Chapter Questions	100	25	13.7
	75	24	13.1		75	61	33.3
	50	39	21.3		50	42	23.0
	25	51	27.9		25	22	12.0
	0	54	29.5		0	33	18.0
n = 183				n = 183			
Performance Checklists	100	13	7.1				
	75	36	19.7				
	50	53	29.0				
	25	47	25.7				
	0	34	18.6				
n = 183							

Table 12

Leadership in Science Education: Teacher Preparation
(% Respondents)

	Has Taken University Courses Within Past 3 Years	Participate in Science Conferences Outside District	Administration Provides Professional Leave to Attend Conferences
STATUS:			
Present	50.3	63.9	87.4
Not Present	49.7	36.1	12.6
RATING:			
Extremely Important	35.0	35.5	65.6
Somewhat Important	23.0	26.2	20.8
Neutral	33.3	31.1	13.1
Somewhat Unimportant	6.6	6.0	0.5
Unimportant	2.2	1.1	0.0
	n = 183	n = 183	n = 183

Table 13

Leadership in Science Instruction: Curriculum Planning
(% Respondents)

	Knows Entire K-12 Science Curric.	Has Input in Science Curric. Planning	Has Opportunity to Reexamine Goals, etc. Every 5 Yrs.	School District Has a Science Coordinator	School Building Has Lead Teacher in Science
STATUS:					
Present	38.3	82.5	59.0	21.9	44.8
Not Present	61.7	17.5	41.0	78.1	55.2
RATING:					
Extremely Important	27.9	55.2	48.6	29.5	29.5
Somewhat Important	36.1	27.3	31.7	30.6	27.9
Neutral	27.9	17.5	19.1	30.1	33.3
Somewhat Unimportant	7.1	0.0	0.5	7.1	7.7
Unimportant	1.1	0.0	0.0	2.7	1.6
	n = 183	n = 183	n = 183	n = 183	n = 183

Table 14

Staff Effectiveness
(% Respondents)

	Participated in Staff Development in My School District's Adopted Science Program	Participate in Staff Development in Science Teaching Methodology	Staff Development Opportunities for Teaching Elementary Science are Offered Regularly
STATUS:			
Present	82.5	83.6	50.8
Not Present	17.5	16.4	49.2
RATING:			
Extremely Important	56.8	57.9	43.7
Somewhat Important	27.9	26.8	36.1
Neutral	13.7	14.8	19.1
Somewhat Unimportant	1.1	0.0	1.1
Unimportant	0.5	0.5	0.0
	n = 183	n = 183	n = 183

Table 15

School Environment: Supplies and Support
(% Respondents)

	Financial Support for Sci. in District is Sufficient	Materials/ Supplies Readily Available for Use	Can Select Support Materials for Science Instruction	Science Equipment Adequate For Our Needs	Adequate # Student Science Texts, etc. Available
STATUS:					
Present	28.9	55.1	65.6	48.0	84.7
Not Present	71.1	44.9	34.4	52.0	15.3
RATING:					
Extremely Important	61.2	71.0	57.9	66.7	49.2
Somewhat Important	24.6	16.4	27.9	21.3	23.0
Neutral	12.6	12.6	14.2	11.5	21.3
Somewhat Unimportant	1.1	0.0	0.0	0.5	4.9
Unimportant	0.5	0.0	0.0	0.0	1.6
	n = 183	n = 183	n = 183	n = 183	n = 183

Table 16

School Environment: Classroom
(% Respondents)

	Classroom Shows Evidence of Ongoing Activities	Class Sizes Are Appropriate for Science Teaching	Classroom Has a Functioning Sink and Faucet	Classroom Has a Sufficient Number of Tables/Desks
STATUS:				
Present	76.5	61.7	44.3	59.0
Not Present	23.5	38.3	55.7	41.0
RATING:				
Extremely Important	49.2	60.1	52.5	51.9
Somewhat Important	29.5	24.0	16.9	25.7
Neutral	20.2	15.8	27.3	21.9
Somewhat Unimportant	1.1	0.0	0.5	0.5
Unimportant	0.0	0.0	2.7	0.0
	n = 183	n = 183	n = 183	n = 183

Table 17

School Environment
(% Respondents)

	Uses a Variety of Instructional Approaches to Teaching Science	Administrators' Attitudes Toward Science Are Positive	Student Discipline is Easily Maintained
STATUS:			
Present	92.4	79.7	83.0
Not Present	7.6	20.3	17.0
RATING:			
Extremely Important	67.2	62.8	60.7
Somewhat Important	20.2	20.8	22.4
Neutral	12.6	15.3	16.4
Somewhat Unimportant	0.0	0.5	0.0
Unimportant	0.0	0.5	0.5
	n = 183	n = 183	n = 183

Table 18

School Environment: Teacher Attitudes
(% Respondents to Question, "Teaching science is . . . ")

Very Enjoyable	Somewhat Enjoyable	Neutral	Somewhat Not Enjoyable	Not Enjoyable	No Response
72.7	17.5	8.7	0.5	0.5	0.0
Very Exciting	**Somewhat Exciting**	**Neutral**	**Somewhat Boring**	**Boring**	**No Response**
62.3	25.7	10.9	0.0	1.1	0.0
Very Satisfying	**Somewhat Satisfying**	**Neutral**	**Somewhat Frustrating**	**Frustrating**	**No Response**
59.0	22.4	16.4	1.1	1.1	0.0
Very Rewarding	**Somewhat Rewarding**	**Neutral**	**Somewhat Unfulfilling**	**Unfulfilling**	**No Response**
61.7	22.4	14.8	0.5	0.5	0.0
Very Comfortable	**Somewhat Comfortable**	**Neutral**	**Somewhat Stressful**	**Stressful**	**No Response**
46.4	29.0	20.8	2.2	1.6	0.0

n = 183

Table 19

School-Community Relationships
(% Respondents)

	Business/ Community is Involved W/Science Within School	Teacher Contributes to Community Organizations	Community Provides Sci. Supplies, Talent, or Equipment for School	People From Community are Utilized for Class or Help With Projects
STATUS:				
Present	18.0	54.1	32.8	25.6
Not Present	82.0	45.9	67.2	74.4
RATING:				
Extremely Important	24.0	14.8	36.6	24.0
Somewhat Important	30.1	27.9	33.9	36.1
Neutral	36.1	37.2	25.7	34.4
Somewhat Unimportant	7.7	15.3	3.3	4.9
Unimportant	2.2	4.9	0.5	0.5
	n = 183	n = 183	n = 183	n = 183

Table 20a

Results of Independent t-test on 44 Survey Items
(Teacher "Haves" and "Wants")

Item #/Item	1993 Mean	1994 Mean	t-value	p
8A I have participated in staff development in my school district's adopted science program	1.699	1.284	5.056	0.000
9A I participate in staff development activities in science teaching methodology	1.754	1.251	6.072	0.000
10A I have taken university courses in science and/or science methodology in the past three years	1.880	2.380	4.887	0.000
11A I participate in science conventions and/or conferences outside my school district	2.274	1.678	5.941	0.000
17A Our science curriculum emphasizes process skills, techniques, methods, equipment, and available technology of science	1.559	1.350	2.915	0.004
18A Our science curriculum emphasizes principles of scientific resarach and student involvement in simple research projects	1.655	1.432	2.779	0.006
19A Our science curriculum emphasizes social/environmental implications/ limitations of technology development	1.761	1.530	2.723	0.007
20A Our science curriculum emphasizes concepts/basic vocabulary of biological, physical, environmental sciences and their application to life and work in contemporary society	1.502	1.273	3.040	0.002
23A I am knowledgeable about the entire K-12 science curriculum in my school district	2.197	1.967	2.485	0.013
26A Science instruction addresses the needs of students with specific learning problems (bilingual, gifted, handicapped, etc.)	1.977	1.792	1.984	0.048

n = 183

Table 20b

Results of Independent t-test on 44 Survey Items
(Teacher "Haves" and "Wants")

Item #/Item	1993 Mean	1994 Mean	t-value	p
27A I have opportunities to provide input in science curriculum planning	1.643	1.251	5.105	0.000
30A Our building has a "lead teacher" in science	2.235	1.923	3.226	0.001
31A Staff development opportunities for teaching elementary science are offered regularly	1.953	1.623	4.227	0.000
32A My administration provides professional leave for me to attend professional meetings/activities	1.514	1.180	4.742	0.000
33A I ask quesions that make students apply what they have learned to everyday life	1.294	1.131	2.548	0.011
39A I use a variety of instructional strategies and approaches in teaching science	1.341	1.164	2.739	0.006
42A Financial support for science in my district is sufficient	2.009	1.820	2.725	0.007
43A Science materials/supplies are readily available for my use	1.784	1.503	4.249	0.000
47A Science equipment is adequate for our needs	1.803	1.607	2.940	0.003
49A Adequate numbers of student science texts, etc. are available	1.514	1.295	2.815	0.005

n = 183

Table 21a

Results of Independent t-test on 44 Survey Items
(Rating of Importance of Item: Extremely Important to Not Important)

Item #/Item	1993 Mean	1994 Mean	t-value	p
8B I have participated in staff development in my school district's adopted science program	3.965	4.393	5.304	0.000
9B I participate in staff development activities in science teaching methodology	3.936	4.415	5.924	0.000
10B I have taken university courses in science and/or science methodology in the past three years	3.364	3.820	4.830	0.000
11B I participate in science conventions and/or conferences outside my school district	3.291	3.891	6.420	0.000
12B My students' parents are involved in science education within our school	3.486	3.689	2.274	0.023
17B Our science curriculum emphasizes process skills, techniques, methods, equipment, and available technology of science	4.385	4.612	3.451	0.001
18B Our science curriculum emphasizes principles of scientific research and student involvement in simple research projects	4.152	4.361	2.825	0.005
19B Our science curriculum emphasizes social/environmental implications/ limitations of technology development	4.040	4.273	3.122	0.002
20B Our science curriculum emphasizes concepts/basic vocabulary of biological, physical, environmental sciences and their application to life and work in contemporary society	4.172	4.339	2.391	0.017

n = 183

Table 21b

Results of Independent t-test on 44 Survey Items
(Rating of Importance of Item: Extremely Important to Not Important)

Item #/Item	1993 Mean	1994 Mean	t-value	p
23B I am knowledgeable about the entire K-12 science curriculum in my school district	3.521	3.825	3.582	0.000
24B My science instruction focus in on problem-solving activities	4.037	4.208	2.373	0.018
27B I have opportunities to provide input in science curriculum planning	4.030	4.377	4.640	0.000
31B Staff development opportunities for teaching elementary science are offered regularly	3.990	4.224	3.084	0.002
32B My administration provides professional leave for me to attend professional meetings/activities	4.157	4.514	4.781	0.000
33B I ask questions that make students apply what they have learned to everyday life	4.448	4.579	2.137	0.033
36B My classroom shows evidence of ongoing science activities (eg. - live animals, childrens' work, etc.)	4.120	4.268	2.077	0.038
42B Financial support for science in my district is sufficient	4.272	4.448	2.445	0.015
43B Science materials/supplies are readily available for my use	4.439	4.585	2.185	0.029

n = 183

Table 22

Results of Independent t-test on Teacher Attitudes Toward Science Teaching ("Teaching science is . . .")*

Item #/Item			1993 Mean	1994 Mean	t-value	p
52	Enjoyable -----	Not Enjoyable	1.695	1.388	4.235	0.000
53	Exciting -----	Boring	1.763	1.519	3.438	0.001
54	Satisfying -----	Frustrating	2.005	1.628	4.385	0.000
55	Rewarding -----	Unfulfilling	1.871	1.557	4.053	0.000
56	Comfortable -----	Stressful	2.136	1.836	3.426	0.001

* Left hand semantics were scored as "1," right hand semantics were scored as "5"

Table 23

Results of Independent t-test on Science Teaching Strategies Employed (Frequency of use of the following strategies)*

Item #/Item		1993 Mean	1994 Mean	t-value	p
57	Laboratory/Hands-on Activities	3.486	3.754	3.338	0.001
58	Microcomputers	1.601	1.913	3.889	0.000
59	Textbooks	3.331	3.049	2.413	0.016
60	Commercialy produced kits	2.422	2.705	2.461	0.014
61	District/Teacher produced kits	2.909	3.197	2.407	0.016
62	Supplemental curricular materials (AIMS, GEMS, etc.)	2.688	3.120	2.976	0.003
63	Lecture	2.953	2.645	3.434	0.001
66	Field Trips	2.632	2.350	2.230	0.026

* Frequency responses were 5 = "100% of the Time (Very Frequent)" through 1 = "0% of the Time (Not Used)"

Table 24

Sources to Which Teachers Turn for Help in Science Teaching*

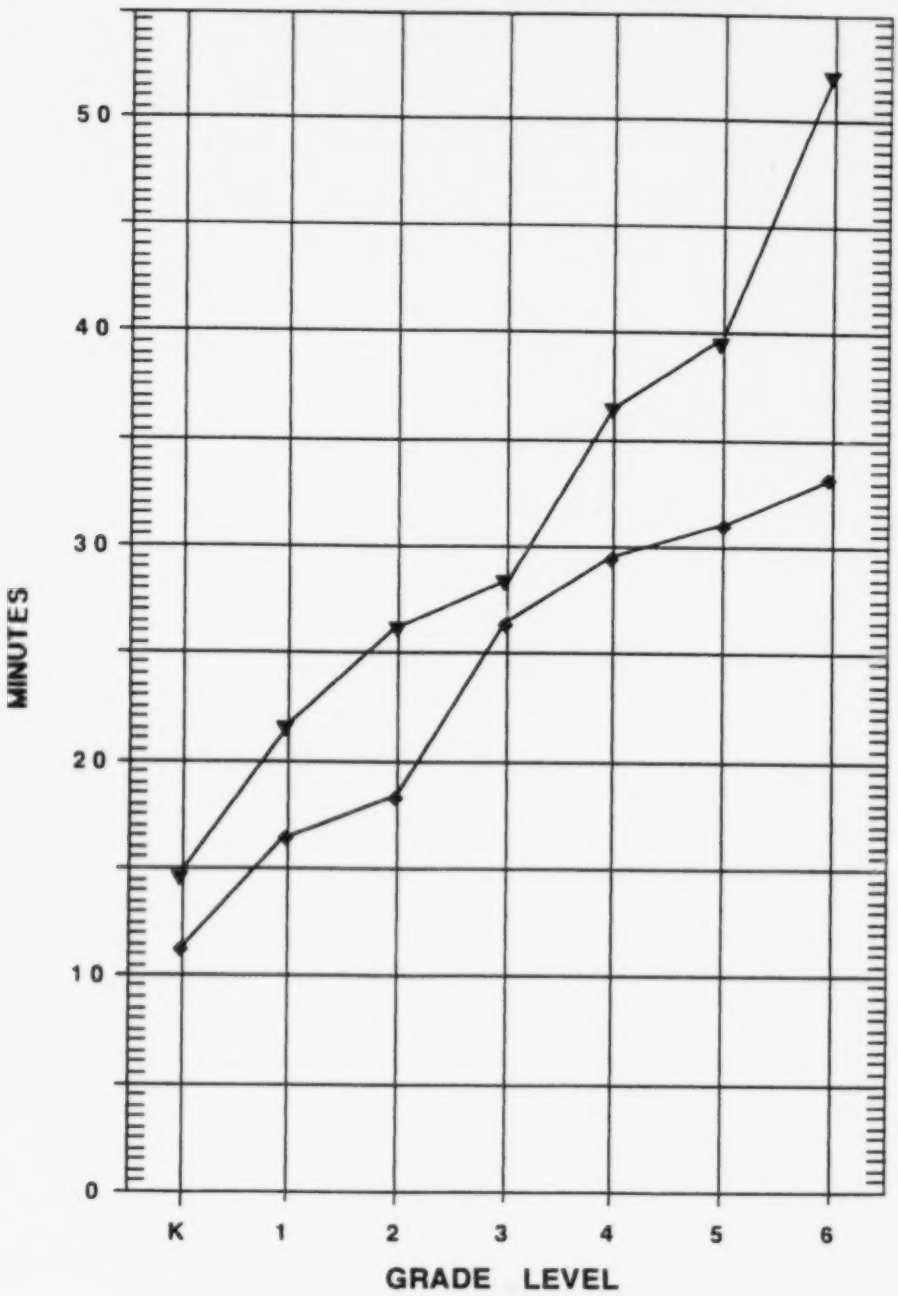
Item #/Item		1993 Mean	1994 Mean	t-value	p
77A	Textbook/Textbook Company	1.287	1.689	4.197	0.000
77B	Educational Service Center	1.411	1.590	1.649	0.100
77C	Educational Service Region (Regional Superintendent)	1.573	1.973	2.371	0.018
77D	University Personnel	1.725	2.082	2.056	0.040
77E	State Agency	1.784	2.016	1.231	0.219
77F	Other	0.803	0.913	1.049	0.294

* Responses were scored as follows: 77A = 1, 77B = 2, 77C = 3, 77D = 4, 77E = 5, 77F = 6

FIGURES AND GRAPHS

Figure 1

MEAN NUMBER OF MINUTES DEVOTED TO TEACHING SCIENCE PER DAY

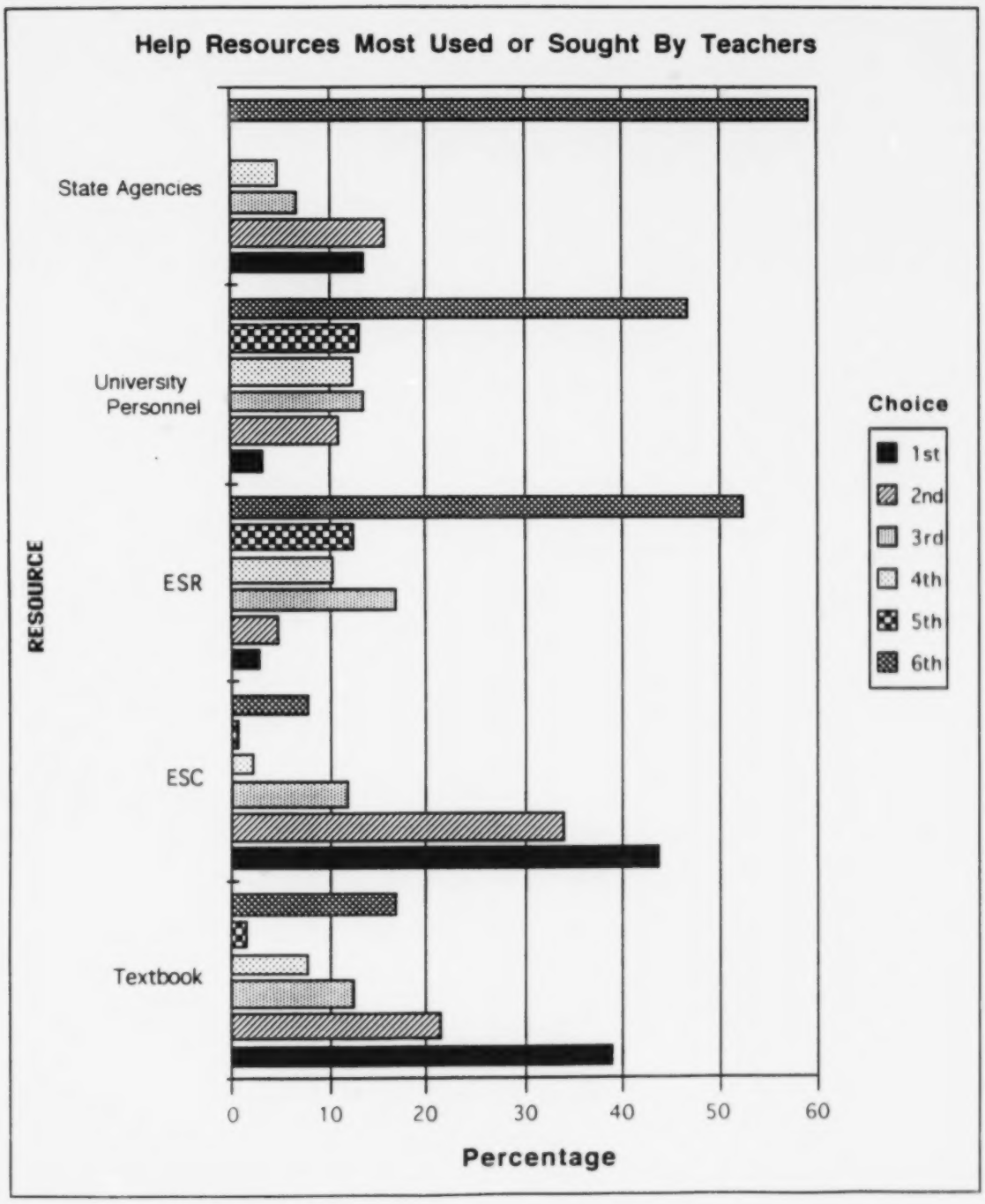


MEANS:	K	1	2	3	4	5	6
▼	14.88	22.45	25.87	26.59	36.33	39.47	53.39
◆	11.23	15.22	15.76	27.17	29.64	31.65	33.13

KEY:
▼ Illinois Target Schools, 1994
◆ Illinois Schools in General, 1993

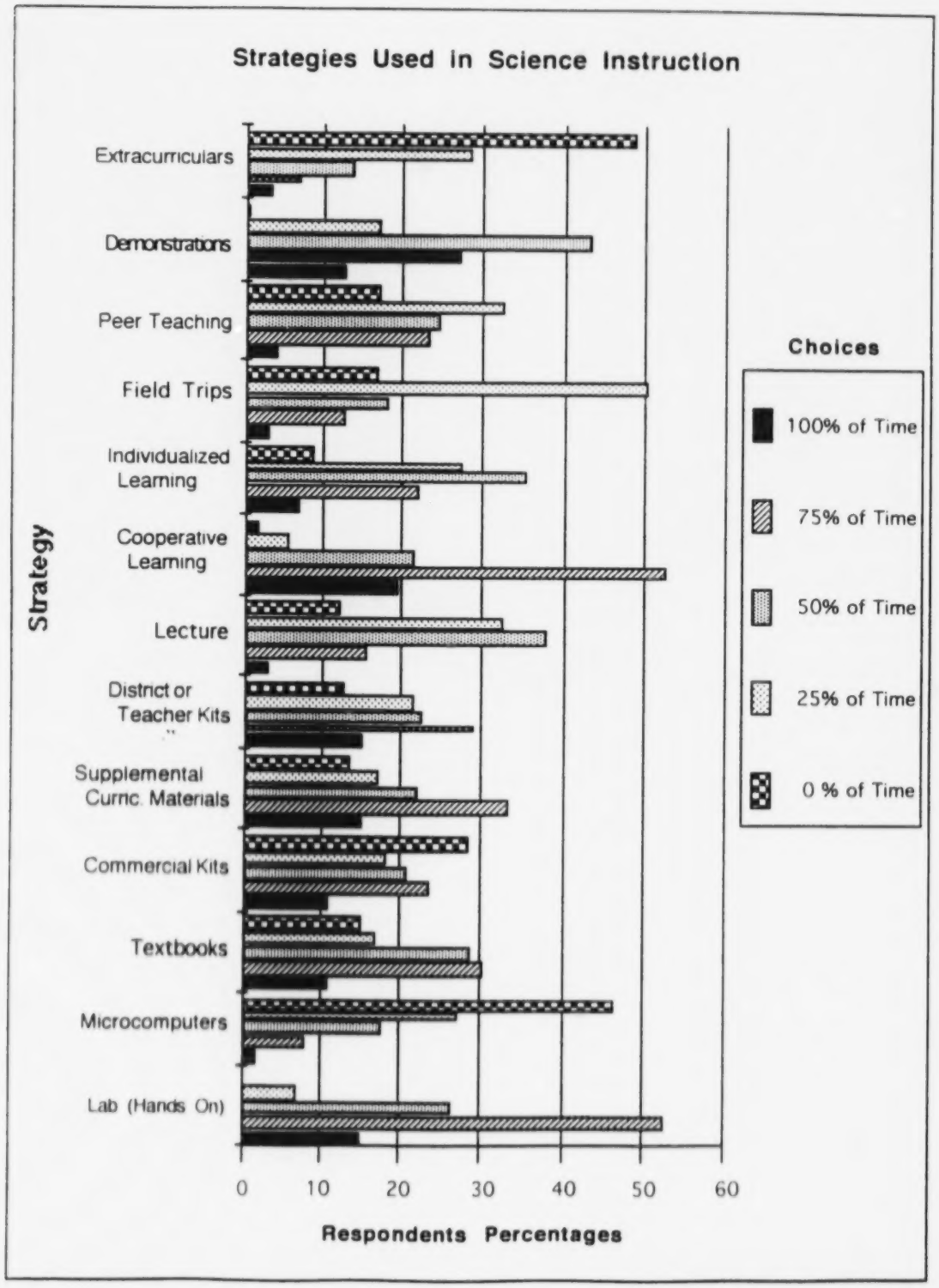
Finson and Beaver, 1994

Graph A



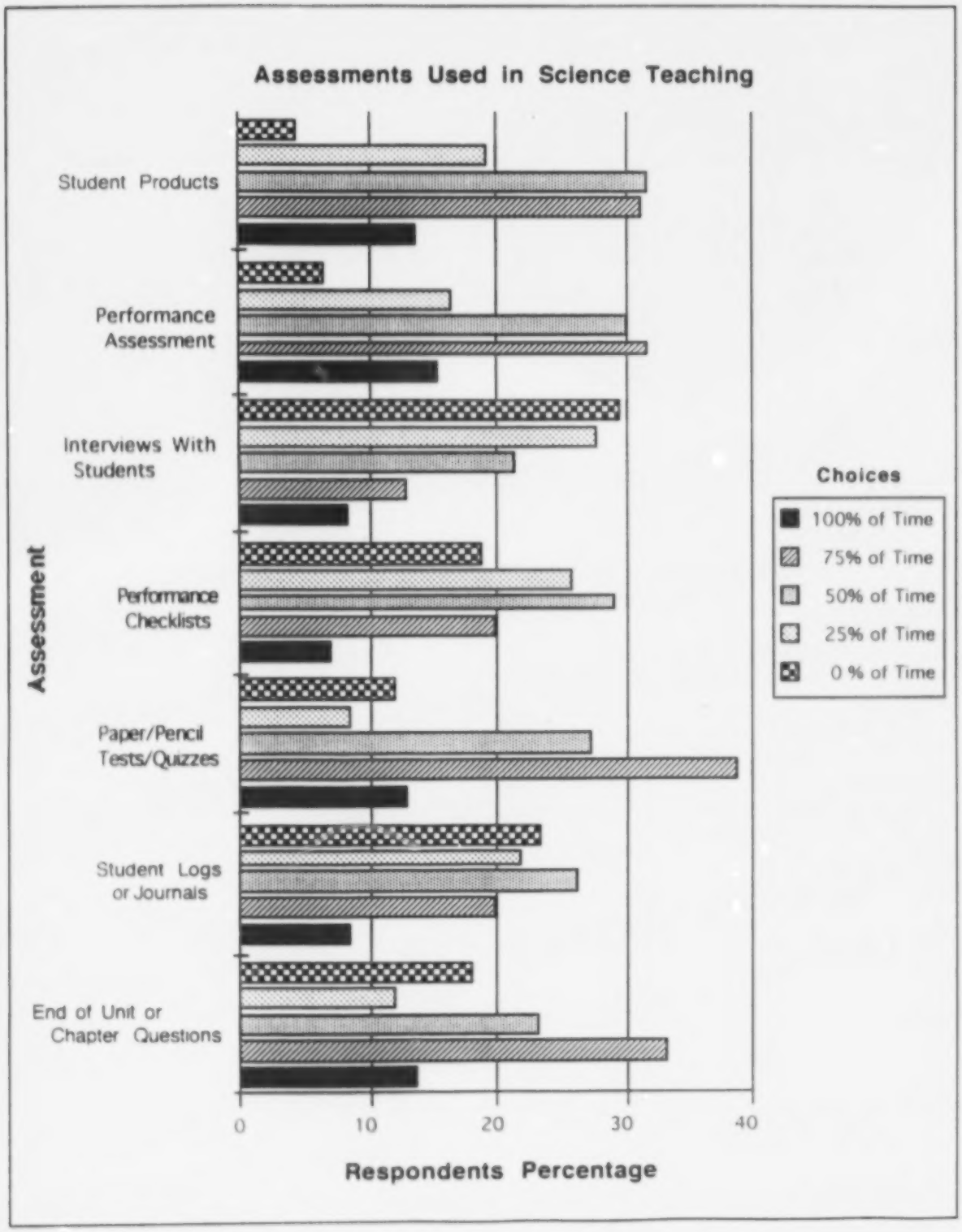
Finson and Beaver, 1994

Graph B



Finson and Beaver, 1994

Graph C

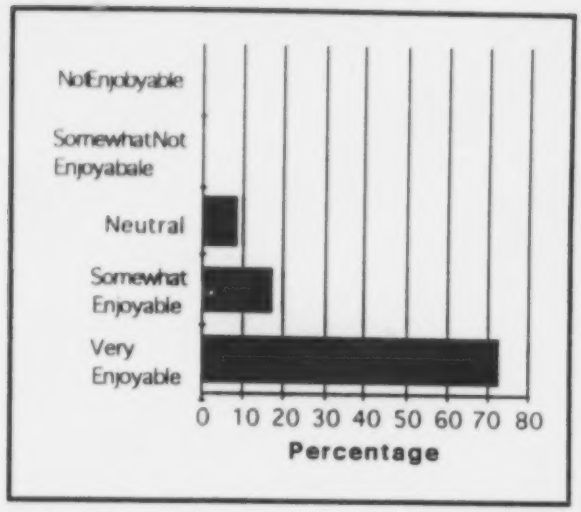


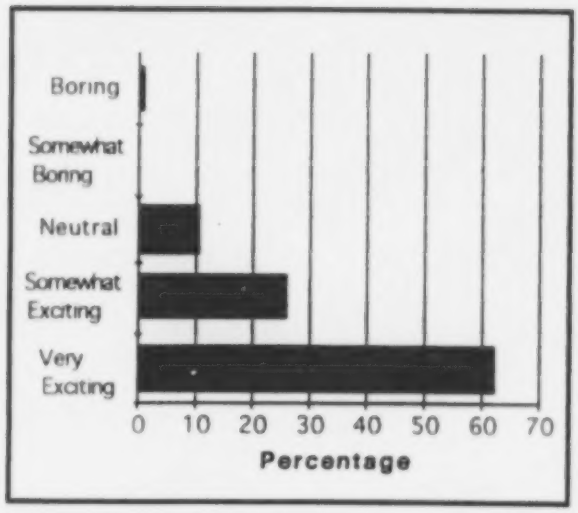
Finson and Beaver, 1994

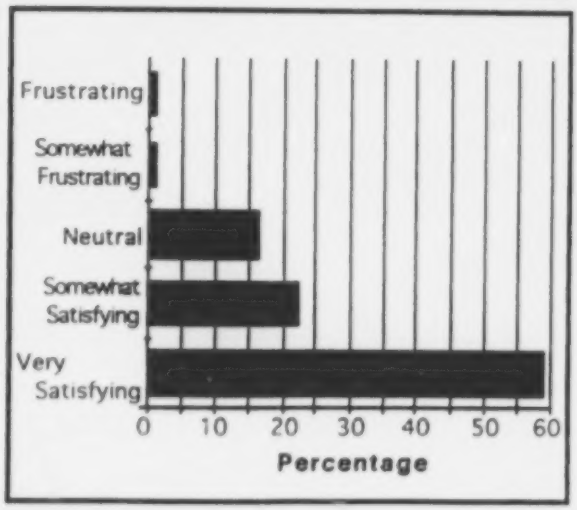
Graph D

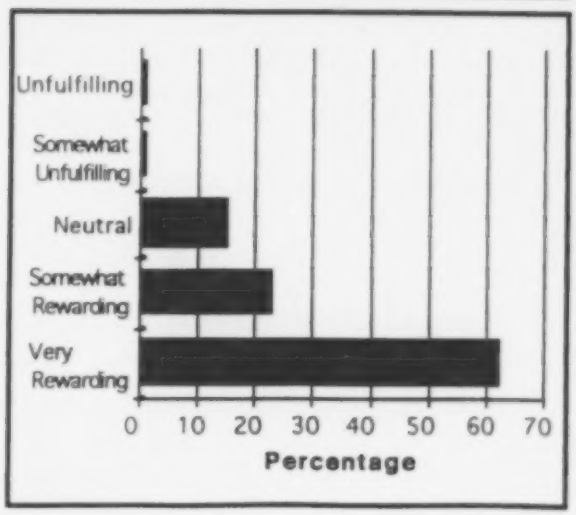
School Environment: Teacher Attitude

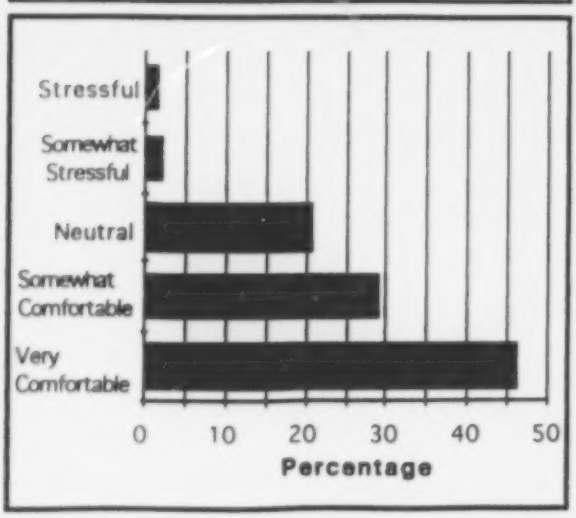
"Teaching Science Is . . . ."





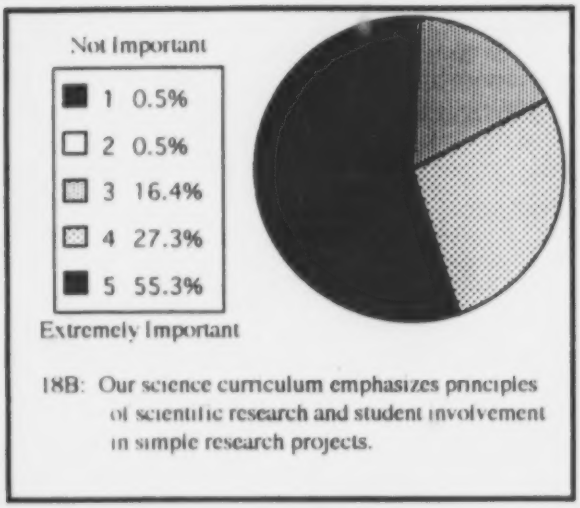




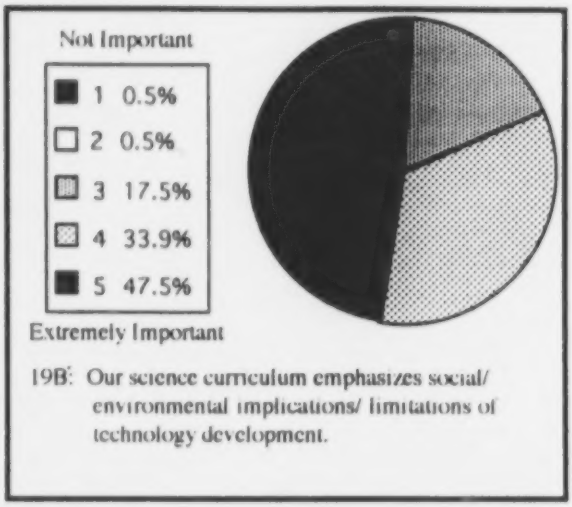


Finson and Beaver, 1994

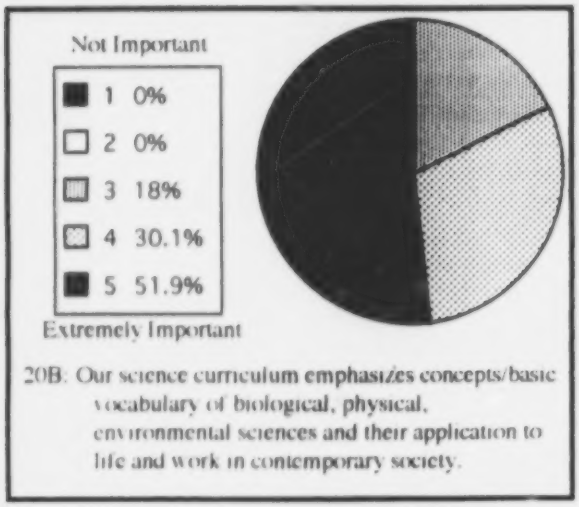
Graph E



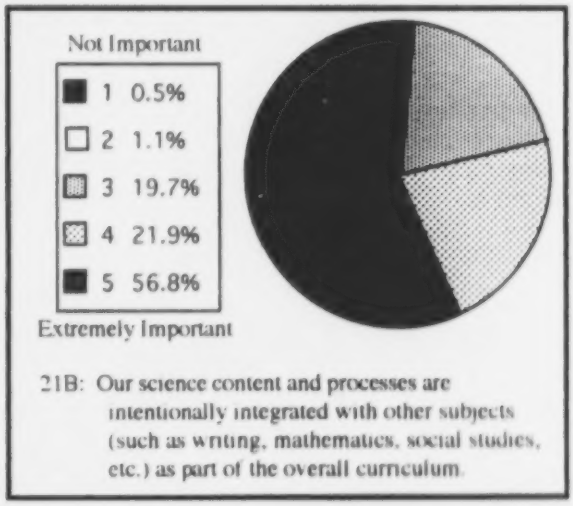
18B: Our science curriculum emphasizes principles of scientific research and student involvement in simple research projects.



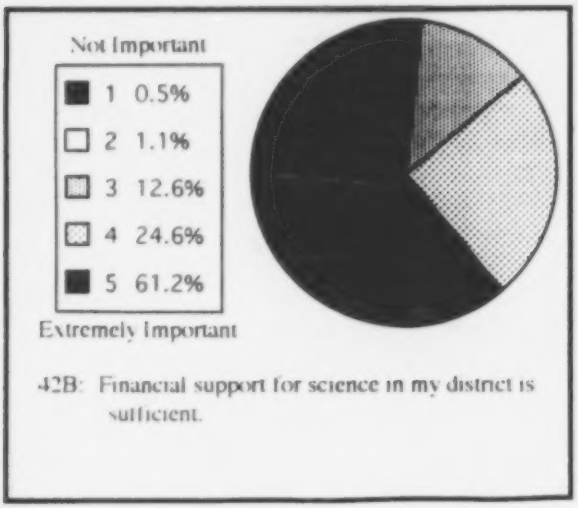
19B: Our science curriculum emphasizes social/ environmental implications/ limitations of technology development.



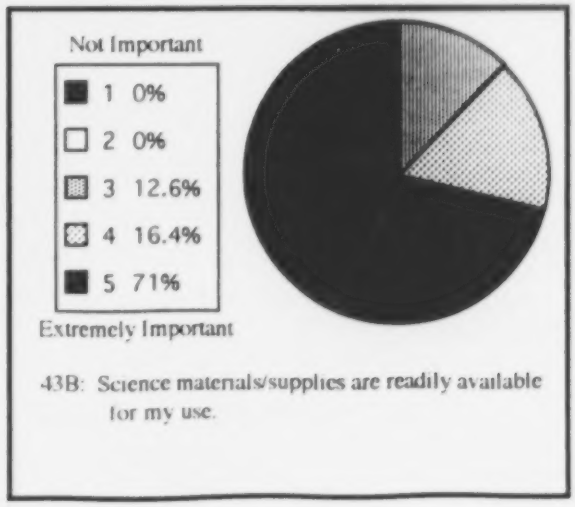
20B: Our science curriculum emphasizes concepts/basic vocabulary of biological, physical, environmental sciences and their application to life and work in contemporary society.



21B: Our science content and processes are intentionally integrated with other subjects (such as writing, mathematics, social studies, etc.) as part of the overall curriculum.



42B: Financial support for science in my district is sufficient.



43B: Science materials/supplies are readily available for my use.

APPENDIX A

WRITTEN SURVEY INSTRUMENT AND COVER LETTERS

wiu Western Illinois University
BOARD OF GOVERNORS UNIVERSITIES

ELEMENTARY EDUCATION AND READING
College of Education
58 Horrabin Hall
Macomb, Illinois 61455-1396
309/298-1961
Fax: 309/298-2222

March 10, 1994

Dear Fellow Educator:

We are extending to you an invitation to participate in an important endeavor. Last year, we conducted a statewide survey of K-6 science teaching in Illinois. This year, again through the auspices of the Illinois State Board of Education, we are conducting a similar survey of Scientific Literacy Target Schools. The purpose of this research is to identify what is actually occurring in science instruction in the Target Schools, of which yours is one. Your responses should reflect your perceptions of what is occurring within your school, not just within your own classroom. This is information only you can provide! Your answers on the enclosed questionnaire will provide information and opinions which will be extremely valuable in planning the future of Science Education in Illinois. As a classroom practitioner and as a member of a Target School team, your answers are vital to establishing accurate baseline data for our state. We estimate the time required to complete the survey will be approximately eleven minutes.

Your responses to this survey will help priortize the State Board of Education's plans to enhance science teaching and learning. We would like you to take a few minutes to complete the survey and return it in the enclosed envelope. Your individual responses will be kept confidential, and only aggregate (group) data will be reported. A percentage of respondents will also be selected to receive an on-site visit from a member of our state research team later this spring. Our efforts to conduct this survey and the on-site visits are supported by your ESC's Scientific Literacy Project Director as well.

If you would like a copy of the summary research report for this study, you may include your name and address at the end of the questionnaire. We will be happy to mail you a complimentary copy of the report when it is ready for distribution. Also, if you have questions, please don't hesitate to contact us.

Please complete the questionnaire and mail it in the return envelope no later than Friday, April 15, 1994. We request you do this even if you participated in the survey last year. Thank you in advance for contributing to our state's science improvement efforts!

Sincerely,

Kevin D. Finson
Project Co-Director
Assoc. Prof. Science Educ.
(309)-298-2101

John B. Beaver
Project Co-Director
Assoc. Prof. Science Educ.
(309)-298-2065

kdf
enc.

58
wiu Western Illinois University
Board of Governors Universities

Elementary Education and Reading
College of Education
58 Horrabin Hall
Macomb, Illinois 61455-1396
309/298-1961
Fax: 309/298-2222

April 18, 1994

Dear Fellow Educator:

Would you please help us?

We are conducting a statewide study of science instruction in grades K-6 in Scientific Literacy Target Schools. We need your help! Last year, we conducted a statewide survey of K-6 science teaching in Illinois. This year we are conducting a similar survey of the Target Schools for the Illinois State Board of Education. The purpose of this research is to identify what is actually occurring in science instruction in the Target Schools. This is information only you can provide. You are extremely valuable in planning for the future of science education in Illinois. The responses from teachers on last year's survey have already proven to be most helpful to ISBE. Your responses on this survey will help even further!

Several weeks ago you received a packet containing a survey form, a return envelope, and a cover letter describing the purposes of this survey. This is a follow-up to that original request. We need to hear from you. Your name was selected by your ESC as a teacher leader in one of the Scientific Literacy Target Schools. Our efforts to conduct this survey are supported by your ESC's Scientific Literacy Project Director as well as the ISBE. Your responses on this survey are extremely vital to the accuracy of this research effort. We need to know what you think and how you feel on these important issues.

We have timed this. It will take you approximately eleven minutes (or less) to fill in your answers to the simple questions on the enclosed questionnaire and return it in the reply envelope. Your responses are completely confidential. Only grouped data will be reported in the final summary and conclusions of this study.

We will be happy to share with you the findings. Please jot your name and address at the end of the survey form, or if you prefer, request the results in a separate letter to the address below. We will be happy to send you a complimentary report when it is printed and ready for distribution. Please be sure your views are represented in this research!

Dr. Kevin D. Finson
Dept. Elementary Education and Reading
Western Illinois University
Macomb, IL 61455

Kindly complete the questionnaire and mail it in the return envelope no later than Wednesday, April 27, 1994. We request you do this even if you participated in the survey last year. Thank you very much for your help!

Sincerely,

Kevin D. Finson

Kevin D. Finson
Project Co-Director
Assoc. Prof. Science Educ.
(309)-298-2101

John B. Beaver
Project Co-Director
Assoc. Prof. Science Educ.
(309)-298-2065

STATE OF ILLINOIS TARGET SCHOOL SCIENCE SURVEY -- 1994

PLEASE MARK ON THIS SURVEY -- THERE IS NO OTHER RESPONSE SHEET

1. Do you teach science as a part of your professional assignment? (If not, kindly give this survey form to an appropriate classroom teacher. Thank you very much!) ____ YES ____ NO
2. Grade Level Taught: ..... _____
3. Average number of minutes devoted to science instruction in your classroom per week: ..... _____
4. My class size this year is: ..... _____
5. I have been teaching for 7 years ..... _____
6. Please indicate the number of pure science courses you have taken at college (i.e., Biology, Chemistry, etc.): _____ Undergraduate _____ Graduate
7. Please indicate the number of science methods courses you have taken at college: _____ Undergraduate _____ Graduate

For the following statements, please mark your responses by coloring the appropriate boxes to the right of each statement. If your present situation matches the statement, please mark the "Have" circle. If you feel you want the condition described, mark the "Want" circle. Then, mark only one box on the scale of "Extremely Important" to "Not Important" which indicates your feeling about the statement. Please write any additional comments you may have in the margins of this survey. Thanks.

	Have	Want	Extremely Important <-----> Not Important
8. I have participated in staff development in my school district's adopted science program	O	O	□ □ □ □ □
9. I participate in staff development activities in science teaching methodology	O	O	□ □ □ □ □
10. I have taken university courses in science and/or science methodology in the past three years	O	O	□ □ □ □ □
11. I participate in science conventions and/or conferences outside my school district	O	O	□ □ □ □ □
12. My students' parents are involved in science education within our school	O	O	□ □ □ □ □
13. Business/Community is involved with science education within my school	O	O	□ □ □ □ □
14. I contribute to community organizations (i.e. nature centers/trails, parks, zoos, museums, etc.)	O	O	□ □ □ □ □
15. My students' science assignments include parent/family involvement	O	O	□ □ □ □ □
16. Community individuals/organizations provide science supplies, talent, and equipment for my school	O	O	□ □ □ □ □
17. Our science curriculum emphasizes process (skills), techniques, methods, equipment, and available technology of science	O	O	□ □ □ □ □

Finson and Beaver, 1994

ILLINOIS K-6 TARGET SCHOOL SURVEY

	Have	Want	Extremely Important <-----> Not Important				
18. Our science curriculum emphasizes principles of scientific research and student involvement in simple research projects	O	O	☐	☐	☐	☐	☐
19. Our science curriculum emphasizes social/environmental implications/limitations of technology development	O	O	☐	☐	☐	☐	☐
20. Our science curriculum emphasizes concepts/basic vocabulary of biological, physical, environmental sciences and their application to life and work in contemporary society	O	O	☐	☐	☐	☐	☐
21. Our science content and processes are intentionally integrated with other subjects (such as writing, mathematics, social studies, etc.) as a part of the overall curriculum design	O	O	☐	☐	☐	☐	☐
22. In my classroom, I follow a written science curriculum scope and sequence describing coordinated and sequential science experiences that are available for each grade level	O	O	☐	☐	☐	☐	☐
23. I am knowledgeable about the entire K-12 science curriculum in my school district	O	O	☐	☐	☐	☐	☐
24. My science instruction focus is on problem-solving activities	O	O	☐	☐	☐	☐	☐
25. I include information about science careers in my science teaching	O	O	☐	☐	☐	☐	☐
26. Science instruction addresses the needs of students with specific learning problems (bilingual, gifted, handicapped, etc.)	O	O	☐	☐	☐	☐	☐
27. I have opportunities to provide input in science curriculum planning	O	O	☐	☐	☐	☐	☐
28. Our science curriculum plan provides opportunities to re-examine goals, strategies, and materials at least every five years	O	O	☐	☐	☐	☐	☐
29. Our district has a science coordinator	O	O	☐	☐	☐	☐	☐
30. Our building has a "lead teacher" in science	O	O	☐	☐	☐	☐	☐
31. Staff development opportunities for teaching elementary science are offered regularly	O	O	☐	☐	☐	☐	☐
32. My administration provides professional leave for me to attend professional meetings/activities	O	O	☐	☐	☐	☐	☐
33. I ask questions that make students apply what they have learned to everyday life	O	O	☐	☐	☐	☐	☐

	Have	Want	Extremely Important <------> Not Important				
34. I encourage students to think rather than merely memorize a lot of science facts	O	O	□	□	□	□	□
35. My students have opportunities to master lessons or units before we move on to new material	O	O	□	□	□	□	□
36. My classroom shows evidence of ongoing science activites (eg.- live animals, children's work, etc.)	O	O	□	□	□	□	□
37. People from the community are utilized for class or individual research projects (eg. local scientists, educators, business leaders, etc.)	O	O	□	□	□	□	□
38. I know procedures for identifying and handling possible hazardous materials	O	O	□	□	□	□	□
39. I use a variety of instructional strategies and approaches in teaching science	O	O	□	□	□	□	□
40. Students are told the objectives of the lesson	O	O	□	□	□	□	□
41. Students' level of interest in science is high	O	O	□	□	□	□	□
42. Financial support for science in my district is sufficient	O	O	□	□	□	□	□
43. Science materials/supplies are readily available for my use	O	O	□	□	□	□	□
44. Administrators' attitudes toward science are positive	O	O	□	□	□	□	□
45. Student discipline is easily maintained	O	O	□	□	□	□	□
46. I can select support materials (library books, films, computer software, etc.) for science instruction	O	O	□	□	□	□	□
47. Science equipment is adequate for our needs	O	O	□	□	□	□	□
48. Class sizes are appropriate for science teaching	O	O	□	□	□	□	□
49. Adequate numbers of student science texts, etc. are available	O	O	□	□	□	□	□
50. My classroom has a functioning sink and faucet	O	O	□	□	□	□	□
51. My classroom has a sufficient number of tables or desks for all students to conduct science activities	O	O	□	□	□	□	□

Please circle the number on each of the following scales which reflects your feeling about teaching science. Teaching science is . . .

52. ENJOYABLE	1	2	3	4	5	NOT ENJOYABLE
53. EXCITING	1	2	3	4	5	BORING
54. SATISFYING	1	2	3	4	5	FRUSTRATING
55. REWARDING	1	2	3	4	5	UNFULFILLING
56. COMFORTABLE	1	2	3	4	5	STRESSFUL

Finson and Beaver, 1994

How often do I use the following in my science teaching:	100% of the Time (Very Frequent) <-----> 0% of the Time (Not Used)				
57. Laboratory/Hands-on activities	☐	☐	☐	☐	☐
58. Microcomputers	☐	☐	☐	☐	☐
59. Textbooks	☐	☐	☐	☐	☐
60. Commercially produced kits (SCIS, GEMS, AIMS, etc.)	☐	☐	☐	☐	☐
61. District/Teacher produced kits	☐	☐	☐	☐	☐
62. Supplemental curricular materials (AIMS, GEMS, etc.)	☐	☐	☐	☐	☐
63. Lecture	☐	☐	☐	☐	☐
64. Cooperative/Small group learning	☐	☐	☐	☐	☐
65. Individualized strategies	☐	☐	☐	☐	☐
66. Field trips	☐	☐	☐	☐	☐
67. Peer teaching	☐	☐	☐	☐	☐
68. Demonstrations	☐	☐	☐	☐	☐
69. Extracurriculars (Science Olympiad, Invent America, etc.)	☐	☐	☐	☐	☐

I use the following assessment techniques in my science instruction:	100% of the Time (Very Frequent) <-----> 0% of the Time (Not Used)				
70. Science products students produce	☐	☐	☐	☐	☐
71. Performance items (laboratory practicals, hands-on tests, etc.)	☐	☐	☐	☐	☐
72. Interviews with individual students	☐	☐	☐	☐	☐
73. Performance checklists	☐	☐	☐	☐	☐
74. Paper-pencil tests/quizzes	☐	☐	☐	☐	☐
75. Student logs/journals/diaries	☐	☐	☐	☐	☐
76. End of chapter/unit questions	☐	☐	☐	☐	☐

77. Please rank order (1 = most used, 2 = next most used, etc.) the following resources to which you turn for help with science curriculum:

_____ Textbook/Textbook company

_____ Educational Service Center

_____ Educational Service Region (Regional Superintendent)

_____ University Personnel

_____ State Agency

_____ Other (Please specify:

_____)

Thank you very much for completing this survey!

Finson and Beaver, 1994

APPENDIX B

SITE SURVEY INSTRUMENT

1994 ILLINOIS SCIENCE SURVEY -- SITE SURVEY & CHECKLIST

School Environment							Written Survey Correlate
TEACHER		PRINCIPAL		STUDENT			
Yes	No	Yes	No	Yes	No		
☐	☐	☐	☐	▨	▨	1. Classroom has . . . a. Science displays (bulletin boards, posters, cages, aquaria, etc.)	36 49
☐	☐	☐	☐	▨	▨	b. Adequate numbers of student science texts available	50
☐	☐	☐	☐	▨	▨	c. Adequate tabletop space for science activities	51
☐	☐	☐	☐	▨	▨	d. Functioning sink with running water	39
☐	☐	☐	☐	▨	▨	e. Good temperature control (room not too hot or too cold)	42
☐	☐	☐	☐	▨	▨	2. Hazardous materials are properly handled/stored if present	44
☐	☐	☐	☐	▨	▨	3. Support for science in the district is . . .	43
☐	☐	☐	☐	▨	▨	a. Financially sufficient	45
☐	☐	☐	☐	▨	▨	b. Materials/Supplies readily accessible and attainable	46
☐	☐	☐	☐	▨	▨	c. Adequate equipment is accessible and attainable	47
☐	☐	☐	☐	▨	▨	d. Administrator attitudes toward science is positive	48
☐	☐	☐	☐	▨	▨	e. Supportive materials can be selected by teachers (library books, films, computer software, etc.) 1) If so, what materials? _____ _____ _____	
☐	☐	☐	☐	▨	▨	4. Student discipline is easily maintained	
☐	☐	☐	☐	▨	▨	5. Class sizes are appropriate for science teaching a. Average class size in building? _____	

Leadership							Written Survey Correlate
TEACHER		PRINCIPAL		STUDENT			
Yes	No	Yes	No	Yes	No		
☐	☐	☐	☐	▨	▨	1. Participation in science conventions/conferences outside school district	11
						a. Which one(s)? _____	32
						_____	77
						b. When?	29
						_____	
						c. Administration provides support for teachers to attend	30
						1) Is support financial?	27
						2) Is support professional leave?	28
						3) Other forms of support? _____	
						_____	
						_____	
						2. District uses specialists/consultants from outside district to assist in science program planning	
						a. Who was used? (agents of ESC, ESR, University, etc.?)	
						_____	
						_____	
						b. What did these persons contribute? _____	
						_____	
						_____	
						3. District has in-house science consultant/specialist	
						4. School building has a "lead teacher" in science	
						5. Teacher has provided input in science curriculum planning during most recent planning efforts of district	
						a. In what way(s) did the teacher contribute?	
						_____	
						_____	
						6. District has re-examined science curriculum goals, strategies, and materials within past five years	
						a. If so, when?	
						_____	

Curriculum

TEACHER Yes	TEACHER No	PRINCIPAL Yes	PRINCIPAL No	STUDENT Yes	STUDENT No		Written Survey Correlate
☐	☐	☐	☐	▨	▨	1. Emphasis on:	
☐	☐	☐	☐	▨	▨	a. Process skills	17
☐	☐	☐	☐	▨	▨	b. Available technology of science	18
☐	☐	☐	☐	▨	▨	c. Equipment	19
☐	☐	☐	☐	▨	▨	d. Simple research projects/activities	20
☐	☐	☐	☐	▨	▨	e. Concepts	21
☐	☐	☐	☐	▨	▨	f. Basic science vocabulary	22
☐	☐	☐	☐	▨	▨	g. Application of sciences to everyday lives of students	23
☐	☐	☐	☐	▨	▨	h. Science-Technology-Society relationships	24
☐	☐	☐	☐	▨	▨	i. Limitations of science and technology	25
☐	☐	☐	☐	▨	▨		34
						j. Integrating science with other subject areas	
						1) What other areas? _____	
						_____	
						_____	
☐	☐	☐	☐	▨	▨	2. District has a written science curriculum scope and sequence guide for each grade level?	
☐	☐	☐	☐	▨	▨	a. If so, how recently has teacher seen it? _____	
☐	☐	☐	☐	▨	▨	b. If so, does teacher follow it closely?	
						c. If so, does teacher know what teachers at other grade levels are teaching (science)?	

ILLINOIS K-6 TARGET SCHOOL SURVEY

Instruction

TEACHER Yes	TEACHER No	PRINCIPAL Yes	PRINCIPAL No	STUDENT Yes	STUDENT No		Written Survey Correlate
☐	☐	☐	☐	☐	☐	1. Science instruction in the classroom focuses on/includes:	26
☐	☐	☐	☐	☐	☐	a. Problem-solving activities	35
☐	☐	☐	☐	☐	☐	b. Higher levels of thinking moreso than memorization	33
☐	☐	☐	☐	▨	▨	c. Career components	40
☐	☐	☐	☐	☐	☐	d. Needs of special students (bilingual, handicapped, gifted,etc.)	57
☐	☐	☐	☐	☐	☐	e. Student mastery of content/concepts before moving on to further material	58
☐	☐	☐	☐	☐	☐	2. Teacher asks application-level questions of students	59
						a. If so, how frequently? _____	60
☐	☐	☐	☐	☐	☐	3. Teacher employs variety of instructional strategies in science teaching	61
						a. If so, are the following used? And if so, frequency of use?	62
							63
						FREQUENCY	64
☐	☐	☐	☐	☐	☐	1) Laboratory/Hands-on activities . . . . _____	65
☐	☐	☐	☐	☐	☐	2) Microcomputers . . . . . _____	66
☐	☐	☐	☐	☐	☐	3) Textbooks . . . . . _____	67
☐	☐	☐	☐	▨	▨	4) Commercial kits . . . . . _____	68
☐	☐	☐	☐	▨	▨	5) District/Teacher-developed kits . . . . _____	69
☐	☐	☐	☐	☐	☐	6) Supplemental science materials . . . . _____	
☐	☐	☐	☐	☐	☐	7) Lecture . . . . . _____	
☐	☐	☐	☐	☐	☐	8) Cooperative/Small Group learning . . _____	
☐	☐	☐	☐	☐	☐	9) Individualized learning . . . . . _____	
☐	☐	☐	☐	☐	☐	10) Field trips . . . . . _____	
☐	☐	☐	☐	☐	☐	11) Peer teaching . . . . . _____	
☐	☐	☐	☐	☐	☐	12) Demonstrations . . . . . _____	
☐	☐	☐	☐	☐	☐	13) Extracurricular Activities (Science Olympiad, Invent America, etc.) . _____	
☐	☐	☐	☐	☐	☐	4. Students' levels of interest in science are high	

Finson and Beaver, 1994

Parental Involvement

TEACHER Yes	TEACHER No	PRINCIPAL Yes	PRINCIPAL No	STUDENT Yes	STUDENT No		Written Survey Correlate
☐	☐	☐	☐	▨	▨	1. Are parents used to help with science in your school? a. If so, how are they used? (in what capacities?) _____ _____ b. If so, how are parents recruited? _____ _____ _____ c. If so, how are parents onented to the task(s)? _____ _____	12
☐	☐	☐	☐	☐	☐	2. Does student homework include parental involvement? a. If so, in what way(s)? _____ _____	

Community/Business Involvement

TEACHER Yes	TEACHER No	PRINCIPAL Yes	PRINCIPAL No	STUDENT Yes	STUDENT No		Written Survey Correlate
☐	☐	☐	☐	▨	▨	1. Does your school receive help for its science program from businesses/the community? a. If so, from whom? _____ _____ _____ _____ b . If so, in what forms does this aid occur? _____ _____ _____ _____	13 14 37
☐	☐	☐	☐	☐	☐	2. Are you involved with community organizations? a. Names of organizations? _____ _____ _____	

Assessment

TEACHER Yes	TEACHER No	PRINCIPAL Yes	PRINCIPAL No	STUDENT Yes	STUDENT No		Written Survey Correlate
						1. Science assessment includes . . .	70
☐	☐	☐	☐	☐	☐	a. Science products of students	71
☐	☐	☐	☐	☐	☐	b. Performance items (lab practicals, etc.) .	72
☐	☐	☐	☐	☐	☐	c. Interviews with individual students	73
☐	☐	☐	☐	☐	☐	d. Performance checklists	74
☐	☐	☐	☐	☐	☐	e. Paper-Pencil tests/quizzes	75
☐	☐	☐	☐	☐	☐	f. Student logs/journals, diaries	76
☐	☐	☐	☐	☐	☐	g. End of chapter/unit questions	
☐	☐	☐	☐	☐	☐	h. Other (Specify):	

FREQUENCY

Staff Effectiveness

TEACHER Yes	TEACHER No	PRINCIPAL Yes	PRINCIPAL No	STUDENT Yes	STUDENT No		Written Survey Correlate
☐	☐	☐	☐	▨	▨	1. Inservices over past year on district's adopted science program	8
						a. If so, when?	31
						b. If so, how frequent?	9
						c. If so, how many?	
☐	☐	☐	☐	▨	▨	2. Inservices over past year on supplementary and/or enrichment science topics	
						a. Names of supplemental/enrichment topics:	
☐	☐	☐	☐	▨	▨	3. Inservices over past year in science teaching methods	

APPENDIX C

SITE SURVEY PERSONNEL

Site Survey Personnel
ISBE Science Literacy Target School Survey -- 1994

Site	Person	Address	Phones
Chicago State	Linda Bell	Access 2000 Program Office 9501 S. King Drive Chicago, IL 60628	(312)-995-2262 (O) (312)-721-6348 (H) (312)-995-3809 FAX
DePaul	Gerald Foster	School of Education 2323 North Seminary Ave. Chicago, IL 60614-3298	(312)-362-8116 (O) (708)-729-1505 (H) (312)-362-5872 FAX e-mail (Internet): EDUGWF@orion.depaul.edu
DePaul	Carole Mitchener	School of Education 2323 North Seminary Ave. Chicago, IL 60614-3298	(312)-362-6590 (O) (708)-366-9380 (H) (312)-362-5872 FAX e-mail (BITNET): EDUCM@DEPAUL
EIU	Marylin Lisowski	Dept. Elem. & Jr. High Ed. Charleston, IL 61920	(217)-581-5728 (O) (217)-345-2742 (H) (217)-581-2518 FAX e-mail (Internet): cfmfl@ux1.cts.eiu.edu
NEIU	Frederick Flener	5500 N. St. Louis Chicago, IL 60625	(312)-794-2755 (O) (708)-692-5446 (H) (312)-794-6243 FAX
NIU	Beth Wilgmann	College of Educ. Dept. C & I Gable Hall DeKalb, IL 60115	(815)-753-0327 (O) (815)-946-2418 (H) (815)-753-9040 (FAX)
SIU-C	Susan Pearlman	Dept. C & I Carbondale, IL 62901	(618)-453-4237 (O) (618)-529-4051 (H)
SIU-E	Virginia Bryan	Dept. Chemistry Box 1652 Edwardsville, IL 62026	(618)-692-3557 (O) (618)-656-1121 (H) (618)-692-3174 (FAX)
WIU	Kevin Finson	Dept. Elem.Educ./Reading Macomb, IL 61455	(309)-298-2101 (O) (309)-833-3425 (H) (309)-298-2222 FAX e-mail (internet): finsonk@ccmail.wiu.bgu.edu
WIU	John Beaver	Dept. Elem.Educ./Reading Macomb, IL 61455	(309)-298-2065 (O) (309)-837-4865 (H) (309)-298-2222 FAX e-mail (internet): jbeaver@ccmail.wiu.bgu.edu

APPENDIX D

RAW DATA

State of Illinois Scientific Literacy Target Schools Survey Results -- 1994

1. Do you teach science as a part of your professional assignment?

Yes	99.5
No	0.5

2. Grade Level Taught:

K	4.9%
1	10.9%
2	12.6%
3	15.8%
4	19.7%
5	20.8%
6	15.3%

3. Average number of minutes devoted to science instruction in your classroom per week:

0	2.2%
1- 35	0.0%
36 - 70	9.8%
71 - 105	15.3%
106 - 140	10.7%
141 - 175	17.9%
176 - 210	22.9%
211 - 245	8.7%
245 - 280	4.2%
> 280	7.3%

4. My class size this year is:

1 - 5	1.1%
6 - 10	1.5%
11 - 15	5.9%
16 - 20	13.6%
21 - 25	38.8%
26 - 30	29.0%
31 - 35	7.0%
36 - 40	1.6%
> 40	1.0%

5. I have been teaching for ? years

< 1	1.1%
1 - 5	11.4%
6 - 10	17.5%
11 - 15	17.0%
16 - 20	20.1%
21 - 25	21.9%
26 - 30	9.2%
31 - 35	0.5%
36 - 40	0.5%
> 40	0.5%

ILLINOIS K-6 TARGET SCHOOL SURVEY

6. Please indicate the number of pure science courses you have taken at college:

Undergraduate		Graduate	
0	9.8%	0	73.8%
1 - 5	67.9%	1 - 5	22.3%
6 - 10	17.5%	6 - 10	3.7%
11 - 15	2.8%	11 - 15	0.0%
>15	2.0%	> 15	0.0%

7. Please indicate the number of science methods courses you have taken at college:

Undergraduate		Graduate	
0	31.1%	0	60.7%
1 - 5	67.7%	1 - 5	32.3%
6 - 10	1.0%	6 - 10	6.5%
11 - 15	0.0%	11 - 15	0.5%
>15	0.0%	> 15	0.0%

	Have	Want	Both Have & Want	Neither Have/Want
8. I have participated in staff development in my school district's adopted science program	81.4%	13.1%	1.1%	4.4%
9. I participate in staff development activities in science teaching methodology	82.5%	13.1%	1.1%	3.3%
10. I have taken university courses in science and/or science methodology in the past three years	50.3%	30.6%	0.0%	19.1%
11. I participate in science conventions and/or conferences outside my school district	63.4%	20.8%	0.5%	15.3%
12. My students' parents are involved in science education within our school	30.6%	50.3%	1.1%	18.0%
13. Business/Community is involved with science education within my school	18.0%	61.7%	0.0%	20.2%
14. I contribute to community organizations (i.e. nature centers, parks, zoos, museums, etc.)	53.6%	21.9%	0.5%	24.0%
15. My students' science assignments include parent/family involvement	66.1%	20.2%	1.1%	12.6%
16. Community individuals/organizations provide science supplies, talent, and equipment for my school	32.2%	57.9%	0.5%	9.3%
17. Our science curriculum emphasizes process (skills), techniques, methods, equipment, and available technology of science	76.0%	17.5%	2.2%	4.4%
18. Our science curriculum emphasizes principles of scientific research and student involvement in simple research projects	71.0%	21.3%	1.1%	6.6%

	Have	Want	Both Have & Want	Neither Have/Want
19. Our science curriculum emphasizes social/ environmental implications/limitations of technology development	64.5%	26.2%	1.1%	8.2%
20. Our science curriculum emphasizes concepts/ basic vocabulary of biological, physical, environmental sciences and their application to life and work in contemporary society	82.5%	12.0%	1.1%	4.4%
21. Our science content and processes are intentionally integrated with other subjects (such as writing, mathematics, social studies, etc.) as a part of the overall curriculum design	57.9%	35.0%	0.5%	6.6%
22. In my classroom, I follow a written science curriculum scope and sequence describing coordinated and sequential science experiences that are available for each grade level	66.1%	21.3%	1.6%	10.9%
23. I am knowledgeable about the entire K-12 science curriculum in my school district	38.3%	44.3%	0.0%	17.5%
24. My science instruction focus is on problem-solving activities	57.9%	28.4%	2.2%	11.5%
25. I include information about science careers in my science teaching	66.7%	20.8%	0.5%	12.0%
26. Science instruction addresses the needs of students with specific learning problems (bilingual, gifted, handicapped, etc.)	52.5%	31.1%	1.1%	15.3%
27. I have opportunities to provide input in science curriculum planning	82.0%	14.2%	0.5%	3.3%
28. Our science curriculum plan provides opportunities to re-examine goals, strategies, and materials at least every five years	59.0%	30.6%	0.0%	10.4%
29. Our district has a science coordinator	21.9%	59.0%	0.0%	19.1%
30. Our building has a "lead teacher" in science	44.3%	37.2%	0.5%	18.0%
31. Staff development opportunities for teaching elementary science are offered regularly	50.3%	43.2%	0.5%	6.0%
32. My administration provides professional leave for me to attend professional meetings/activities	86.3%	10.9%	1.1%	1.6%
33. I ask questions that make students apply what they have learned to everyday life	92.3%	4.4%	1.1%	2.2%
34. I encourage students to think rather than merely memorize a lot of science facts	92.3%	4.4%	1.6%	1.6%
35. My students have opportunities to master lessons or units before we move on to new material	65.0%	21.9%	0.5%	12.6%

ILLINOIS K-6 TARGET SCHOOL SURVEY

	Have	Want	Both Have & Want	Neither Have/Want
36. My classroom shows evidence of ongoing science activites (eg. live animals, children's work, etc.)	74.9%	18.6%	1.6%	4.9%
37. People from the community are utilized for class or individual research projects (eg. local scientists, educators, business leaders, etc.)	25.1%	58.5%	0.5%	15.8%
38. I know procedures for identifying and handling possible hazardous materials	40.4%	39.9%	0.5%	19.1%
39. I use a variety of instructional strategies and approaches in teaching science	90.2%	5.5%	2.2%	2.2%
40. Students are told the objectives of the lesson	84.7%	5.5%	1.6%	8.2%
41. Students' level of interest in science is high	80.9%	10.4%	1.1%	7.7%
42. Financial support for science in my district is sufficient	28.4%	66.1%	0.5%	4.9%
43. Science materials/supplies are readily available for my use	54.6%	42.6%	0.5%	2.2%
44. Administrators' attitudes toward science are positive	78.7%	14.8%	1.0%	5.5%
45. Student discipline is easily maintained	79.8%	12.6%	3.2%	4.4%
46. I can select support materials (library books, films, computer software, etc.) for science instruction	64.5%	29.0%	1.1%	5.5%
47. Science equipment is adequate for our needs	46.4%	49.2%	1.6%	2.7%
48. Class sizes are appropriate for science teaching	61.2%	33.9%	0.5%	4.4%
49. Adequate numbers of student science texts, etc. are available	84.2%	8.7%	0.5%	6.6%
50. My classroom has a functioning sink and faucet	44.3%	50.8%	0.0%	4.9%
51. My classroom has a sufficient number of tables or desks for all students to conduct science activities	57.9%	37.2%	1.1%	3.8%

Teaching science is . . .

52.	ENJOYABLE 72.7%	ENJOYABLE 17.5%	SOMEWHAT NEUTRAL 8.7%	ENJOYABLE 0.5%	SOMEWHAT NOT NOT ENJOYABLE 0.5%
53.	EXCITING 62.3%	SOMEWHAT EXCITING 25.7%	NEUTRAL 10.9%	SOMEWHAT BORING 0.0%	BORING 1.1%$
54.	SATISFYING 59.0%	SOMEWHAT SATISFYING 22.4%	NEUTRAL 16.4%	SOMEWHAT FRUSTRATING 1.1%	FRUSTRATING 1.1%
55.	REWARDING 61.7%	SOMEWHAT REWARDING 22.4%	NEUTRAL 14.8%	SOMEWHAT UNFULFILLING 0.5%	UNFULFILLING 0.5%
56.	COMFORTABLE 46.4%	SOMEWHAT COMFORTABLE 29.0%	NEUTRAL 20.8%	SOMEWHAT STRESSFUL 2.2%	STRESSFUL 1.6%

ILLINOIS K-6 TARGET SCHOOL SURVEY

How often do I use the following in my science teaching:

Percent of the time used . . .	0%	25%	50%	75%	100%
57. Laboratory/Hands-on activities	0.0%	6.6%	26.2%	52.5%	14.8%
58. Microcomputers	46.4%	26.8%	17.5%	7.7%	1.6%
59. Textbooks	14.8%	16.4%	28.4%	30.12%	10.4%
60. Commercially produced kits (SCIS, GEMS, AIMS, etc.)	27.9%	18.0%	20.2%	23.5%	10.4%
61. District/Teacher produced kits	13.1%	16.9%	21.9%	33.3%	14.8%
62. Supplemental curricular materials (AIMS, GEMS, etc.)	12.6%	21.3%	22.4%	29.0%	14.8%
63. Lecture	12.0%	32.2%	37.7%	15.3%	2.7%
64. Cooperative/Small group learning	1.6%	5.5%	21.3%	52.5%	19.1%
65. Individualized strategies	8.7%	27.3%	35.5%	21.9%	6.6%
66. Field trips	16.4%	50.3%	18.0%	12.6%	2.7%
67. Peer teaching	16.9%	32.2%	24.0%	23.0%	3.8%
68. Demonstrations	0.5%	16.9%	43.2%	26.8%	12.6%
69. Extracurriculars (Science Olympiad, Invent America, etc.)	48.6%	27.9%	13.7%	6.6%	3.3%

I use the following assessment techniques in my science instruction:

Percent of time used . . .	0%	25%	50%	75%	100%
70. Science products students produce	4.4%	19.1%	31.7%	31.7%	13.7%
71. Performance items (laboratory practicals, hands-on tests, etc.)	6.6%	16.4%	30.1%	31.7%	15.3%
72. Interviews with individual students	29.5%	27.9%	21.3%	13.1%	8.2%
73. Performance checklists	18.6%	25.7%	29.0%	19.7%	7.1%
74. Paper-pencil tests/quizzes	12.0%	8.7%	27.3%	38.8%	13.1%
75. Student logs/journals/diaries	23.5%	21.9%	26.2%	19.7%	8.7%
76. End of chapter/unit questions	18.0%	12.0%	23.0%	33.3%	13.7%

77. Please rank order (1 = most used, 2 = next most used, etc.) the following resources to which you turn for help with science curriculum:

Source	Ranking: Most (1) to Least (6) Used						
	1st	2nd	3rd	4th	5th	6th	NR
Textbook/Textbook Company	39.9%	21.3%	12.6%	7.7%	1.6%	1.6%	15.3%
Educational Service Center	43.7%	33.9%	12.0%	2.2%	0.5%	0.0%	7.7%
Educational Service Region (Regional Superintendent)	2.7%	4.9%	16.9%	10.4%	12.6%	4.9%	47.5%
University Personnel	3.3%	10.9%	13.7%	12.6%	13.1%	4.4%	42.1%
State Agency	1.1%	5.5%	8.7%	16.9%	12.6%	5.5%	49.7%
Other	13.7%	15.8%	6.6%	4.9%	0.0%	1.1%	57.9%

	Extremely Important	Important	Neutral	Somewhat Unimportant	Unimportant
8. I have participated in staff development in my school district's adopted science program	56.8%	27.9%	13.7%	1.1%	0.5%
9. I participate in staff development activities in science teaching methodology	57.9%	26.8%	14.8%	0.0%	0.5%
10. I have taken university courses in science and/or science methodology in the past three years	35.0%	23.0%	33.3%	6.6%	2.2%
11. I participate in science conventions and/or conferences outside my school district	35.5%	26.2%	31.1%	6.0%	1.1%
12. My students' parents are involved in science education within our school	25.1%	30.6%	33.9%	8.4%	1.6%
13. Business/Community is involved with science education within my school	24.0%	30.1%	36.1%	7.7%	2.2%
14. I contribute to community organizations (i.e. nature centers, parks, zoos, museums, etc.)	14.8%	27.9%	37.2%	15.3%	4.9%
15. My students' science assignments include parent/family involvement	31.1%	34.4%	28.4%	4.4%	1.6%
16. Community individuals/organizations provide science supplies, talent, and equipment for my school	36.6%	33.9%	25.7%	3.3%	0.5%
17. Our science curriculum emphasizes process (skills), techniques, methods, equipment, and available technology of science	73.2%	15.3%	10.9%	0.5%	0.0%
18. Our science curriculum emphasizes principles of scientific research and student involvement in simple research projects	55.2%	27.3%	16.4%	0.5%	0.5%

	Extremely Important	Important	Neutral	Somewhat Unimportant	Unimportant
19. Our science curriculum emphasizes social/ environmental implications/limitations of technology development	47.5%	33.9%	17.5%	0.5%	0.5%
20. Our science curriculum emphasizes concepts/basic vocabulary of biological, physical, environmental sciences and their application to life and work in to life and work in contemporary society	51.9%	30.1%	18.0%	0.0%	0.0%
21. Our science content and processes are intentionally integrated with other subjects (such as writing, mathematics, social studies, etc.) as a part of the overall curriculum design	56.8%	21.9%	19.7%	1.1%	0.5%
22. In my classroom, I follow a written science curriculum scope and sequence describing coordinated and sequential science experiences that are available for each grade level	36.1%	30.6%	26.8%	3.3%	3.3%
23. I am knowledgeable about the entire K-12 science curriculum in my school district	27.9%	36.1%	27.9%	7.1%	1.1%
24. My science instruction focus is on problem-solving activities	45.4%	31.7%	21.3%	1.6%	0.0%
25. I include information about science careers in my science teaching	23.5%	32.8%	35.0%	6.6%	2.2%
26. Science instruction addresses the needs of students with specific learning problems (bilingual, gifted, handicapped, etc.)	38.8%	29.5%	28.4%	3.3%	0.0%
27. I have opportunities to provide input in science curriculum planning	55.2%	27.3%	17.5%	0.0%	0.0%

	Extremely Important	Important	Neutral	Somewhat Unimportant	Unimportant
28. Our science curriculum plan provides opportunities to re-examine goals, strategies, and materials at least every five years	48.6%	31.7%	19.1%	0.5%	0.0%
29. Our district has a science coordinator	29.5%	30.6%	30.1%	7.1%	2.7%
30. Our building has a "lead teacher" in science	29.5%	27.9%	33.3%	7.7%	1.6%
31. Staff development opportunities for teaching elementary science are offered regularly	43.7%	36.1%	19.1%	1.1%	0.0%
32. My administration provides professional leave for me to attend professional meetings/activities	65.6%	20.8%	13.1%	0.5%	0.0%
33. I ask questions that make students apply what they have learned to everyday life	69.9%	18.0%	12.0%	0.0%	0.0%
34. I encourage students to think rather than merely memorize a lot of science facts	73.2%	15.3%	11.5%	0.0%	0.0%
35. My students have opportunities to master lessons or units before we move on to new material	41.0%	31.1%	24.6%	2.7%	0.5%
36. My classroom shows evidence of ongoing science activites (eg. live animals, children's work, etc.)	49.2%	29.5%	20.2%	1.1%	0.0%
37. People from the community are utilized for class or individual research projects (eg. local scientists, educators, business leaders, etc.)	24.0%	36.1%	34.4%	4.9%	0.5%
38. I know procedures for identifying and handling possible hazardous materials	53.0%	18.6%	20.2%	4.9%	3.3%
39. I use a variety of instructional strategies and approaches in teaching science	67.2%	20.2%	12.6%	0.0%	0.0%

Extremely

Somewhat

	Important	Important	Neutral	Unimportant	Unimportant
40. Students are told the objectives of the lesson	53.6%	23.0%	19.7%	3.3%	0.5%
41. Students' level of interest in science is high	66.1%	19.7%	14.2%	0.0%	0.0%
42. Financial support for science in my district is sufficient	61.2%	24.6%	12.6%	1.1%	0.5%
43. Science materials/supplies are readily available for my use	71.0%	16.4%	12.6%	0.0%	0.0%
44. Administrators' attitudes toward science are positive	62.8%	20.8%	15.3%	0.5%	0.5%
45. Student discipline is easily maintained	60.7%	22.4%	16.4%	0.0%	0.5%
46. I can select support materials (library books, films, computer software, etc.) for science instruction	57.9%	27.9%	14.2%	0.0%	0.0%
47. Science equipment is adequate for our needs	66.7%	21.3%	11.5%	0.5%	0.0%
48. Class sizes are appropriate for science teaching	60.1%	24.0%	15.8%	0.0%	0.0%
49. Adequate numbers of student science texts, etc. are available	49.2%	23.0%	21.3%	4.9%	1.6%
50. My classroom has a functioning sink and faucet	52.5%	16.9%	27.3%	0.5%	2.7%
51. My classroom has a sufficient number of tables or desks for all students to conduct science activities	51.9%	25.7%	21.9%	0.5%	0.0%

TEACHER COMMENTS WRITTEN ON SURVEYS

Curriculum

17. Our science curriculum emphasizes process(skills), techniques, methods, equipment, and available technology of science.
- working toward this goal in curriculum development committee
- we're in the process of adopting a new Science Program in the 1994-95 school year
- definitely in 5th grade, I deliberately teach them and call them "process skills". I know other grade levels do a lot of hands-on, and while they cover process skills, its a sort of "built in" act.
- at least 50% of teachers more each year
- want more

18. Our science curriculum emphasizes principles of scientific research and student involvement in simple research projects.
- top school in Reg. 6 Sci. Fair: 20 outstandings
- for certain grade levels
- want more of
- definitely upper grades
- in some areas
- I wrote our science curriculum with goals 1-4 in mind, however, I am sure individual teachers stress goals differently
- 6th grade Science Fair, however, too often parents do much of the projects that win
- curriculum taken is taken directly from text; not necessarily what I feel is appropriate for hands-on

19. Our science curriculum emphasizes social/environmental implications/limitations of technology development.
- needs more
- somewhat

20. Our science curriculum emphasizes concepts/basic vocabulary of biological, physical, environmental sciences and their application to life and work in contemporary society.
- want more of
- in some areas

21. Our science content and processes are intentionally integrated with other subjects (such as writing, mathematics, social studies, etc.) as a part of the overall curriculum design.
- need more
- we are semi-departmentalized; reading is integrated
- very much
- my personal classroom, not necessaily the district's

22. In my classroom, I follow a written science curriculum scope and sequence describing coordinated and sequential science experiences that are available for each grade level.
- we are writing this now
- not really <u>wanted</u>; flexibility is good as long as curriclum guidelines are followed
- an adequate amount of teachers are integrating science with other subjects
- I try
- sometimes include other things
- the text is our curriculum, although this year we have divided units for each grade
- we are beginning this work within a month with quality review etc.
- working on consolidated curriculum
- I cover each area of science equally but give students choices between the exact kit we'll use
- no
- 4,5,6 are sequential, I don't know about K-3: all are written
- I use one worked on as a target school, but not the "district" curriculum; kindergarten usually gets left behind.

TEACHER COMMENTS WRITTEN ON SURVEYS

23. I am knowledgeable about the entire K-12 science curriculum in my school district.

- K-8, yes
- my school district has developed their own science curriculum
- much better
- not completely familiar
- somewhat
- yes, I wrote the curriculum
- no
- I have a general knowledge of K-12 but not specific

24. My science instruction focus in on problem-solving activities.

- difficult for my age students, but that's the direction we're hoping to achieve
- some, but want to do more
- some units, others not so much
- focus is on hands-on activities
- I think there should be some, but at grade 3 they should be learning facts and exploring
- getting better!
- NO hands-on experiments which include problem solving

25. I include information about science careers in my science teaching.

- again, not in all units, but most - though brief
- some
- at kindergarten level
- probably need more

34. I encourage students to think rather than merely memorize a lot of science facts.

- I try
- need more!
- YES!

77. Rank, in order (1=most used, etc.), the following resources to which you turn for help with science curriculum:

- Textbook/Textbook company(#2)
- Univ. personnel(3)
- Ed. Service Center(#1)
- State Agency(#5)
- Ed. Service Region(Reg.Supt)(#4)

OTHER:

- other teachers/staff/colleagues ideas/materials(#1)
- my <u>own</u> abilities, knowledge, education, books, magazines, purchases(#2)
- what I have personally purchased; $300/yr in science!
- district coordinator(#3)
- Science workshops(#4)
- Farm Bureau(#5)
- science magazines & resource books, professional journals(#5)
- whole language/hands-on units for science(#6)
- 4H club(#6)
- public library(#6)
- AIMS, DELTA, DASH, MASH material (6)
- parents
- convention ideas
- films
- community resources: PTO, parents, businesses, etc.
- Lake County SWCD
- Edison Company
- occasional question to a prof. of biochem.
- Education Center of Field Museum
- U of IL Extension Center
- Green Thumb Volunteers
- Lakeview Museum (Peoria)
- Early American Museum
- Adopt-A-School program
- guest speakers
- fish & wildlife agency
- National Wildlife
- district 47 Science Consultant, Roseann Feldman
- maps, globes
- field trips
- canal
- Forest Glen, Kennekuk Cove (county parks employees, outstanding to work with!)

TEACHER COMMENTS WRITTEN ON SURVEYS

Instructional Process

26. Science instruction addresses the needs of students with specific learning problems (bilingual, gifted, handicapped, etc.)
- only handicapped
- use a variety of tests, from written to hands-on
- we do not hold special classes in our district
- also learning disabled

33. I ask questions that make students apply what they have learned to everyday life.
- I hope so!
- probably should ask more

35. My students have opportunities to master lessons or units before we move on to new material.
- not 100%
- in theory its supposed to work this way
- not all students are ready for mastery at a given time
- each year introduces new items but also reviews what was worked on previously
- sometimes we run out of time and need to move on
- kindergarten is more of an introduction to the world

38. I know procedures for identifying and handling possible hazardous materials.
- somewhat
- we do not work with hazardous materials; we do stress keeping things from mouth, eyes, etc.
- we don't use these at our grade level
- I generally don't have this kind of thing in class
- this would not be part of our program
- I am learning
- I don't want too much hazardous stuff at my level!
- I know about what I work with
- NO

40. Students are told the objectives of the lesson.
- always
- depends on lesson

41. Students' level of interest in science is high.
- dramatic increase with implementation of hands-on
- not all kids, all the time, in all units
- I hope!
- for most
- not all folks are science-oriented; this is the way life is!
- in my classroom it is high only

57. Laboratory/Hands-on activities:
- as much as possible
- hands-on but we don't have labs

58. Microcomputers:
- not available
- only for reseach projects; CD ROM
- not enough equipment, software
- only one in classroom
- thanks to our ESC we have Optical Data's Windows On Science
- the ESC obtained our laser discs players and Windows On Science program, which we use extensively and for which we are eternally grateful!!

59. Textbooks:
- for homework
- rarely
- related books
- 60%
- Science Big Book
- we have a laser disk basal

60. Commercially produced kits (SCIS,GEMS,AIMS,etc.):
- Windows on Science
- 40%
- goes with HBJ; very helpful, easy to use
- second grade uses some AIMS kits

61. District/Teacher produced kits:
- few available
- science literacy plans, assessments, rubrics

TEACHER COMMENTS WRITTEN ON SURVEYS

- some are poor quality
- purchased many kits myself

62. Supplemental curricular materials(AIMS,GEMS,etc.):
- Windows on Science
- AIMS
- not available, to my knowledge
- I am not familiar with these materials

64. Cooperative/Small group learning:
- not available
- yes!

66. Field trips:
- the two trips we take a year are both culminations of science units
- district doesn't allow it
- when possible
- four days, in woods
- $ not available in district
- would like to very much

67. Peer teaching:
- cross grade level

68. Demonstrations:
- cross grade level

69. Extracurriculars (Science Olympiad, Invent American, etc.):
- this goes on all year through State Science Fair & State Olympiad
- none for kindergarten
- before cutbacks, yes!
- Science Olympiad, but that starts with junior high students
- guest speakers
- local Science Fair

Assessment

72. Interviews with individual students:
- once or twice a grading period

73. Performance checklists:
- I plan to try this next year

75. Student logs/journals/diaries:
- I should do this more

76. End of chapter/unit questions:
- please note: often more than one type of assessment is used in same unit

Leadership

10. I have taken university courses in science and/or science methodology in the past three years.
- have not participated in actual courses, but in workshops.
- prefer demonstrations, hands-on approach rather than methodology

11. I participate in science conventions and/or conferences outside my school district.
- not recently
- WOS

27. I have opportunities to provide input in science curriculum planning.
- have somewhat in the past
- I am the committee
- but not necessarily listened to

28. Our science curriculum plan provides opportunities to re-examine goals, stategies, and materials at least every five years.
- 6 yrs.
- sometimes 6 or 7 years
- I don't know!
- about 7 years
- this is what we've told the State for quality review
- but I do not feel they implement all the important processes as a district, many teachers do
- we are financially stuck!

29. Our district has a science coordinator.
- we have an assistant supt. of instruction

TEACHER COMMENTS WRITTEN ON SURVEYS

- no, not needed
- as we grow larger, this may become desirable
- lost ours through lack of funds
- a science coach in each building
- Carol Van De Walle is like this
- an excellent one until recently
- committee of teachers do this
- only while we are revising the curriculum
- we have only 8 full time teachers, K-8

30. Our building has a "lead teacher" in science.

- no
- ??
- informally we have a primary, intermediate and jr.high person
- our building has a "sort of" lead teacher" in science
- Carol VanDeWalle
- we have only 8 full time teachers, K-8
- yes, me!

32. My administration provides professional leave for me to attend professional meeting/activities.

- total of $100.00 per year
- science lit grant has provided these opportunities
- did for 2+ years then felt we were out of the classroom too much and really cut back on our release time. What a shame!
- at my own expense

Staff Effectiveness

8. I have participated in staff development in my school district's adopted science program.

- we have a science discovery center (1/2 yr) for students, and staff inservice of hands-on science
- and want more
- WOS - hands on kits

9. I participate in staff development activities in science teaching methodology.

- hands-on

10. I have taken university courses in science and/or science methodology in the past three years.

- have not participated in actual courses, but in workshops.
- prefer demonstrations, hands-on approach rather than methodology

31. Staff development opportunities for teaching elementary science are offered regularly.

- science lit grant has provided these opportunities
- no
- within each grade level
- about every three years
- target schools
- ESC's provide, through workshops
- yes, because of target program
- at some levels

School Environment

36. My classroom shows evidence of ongoing science activities.

- museum cases and experience boxes
- classroom temperature varies too much
- no room
- space and time are BIG limitations
- during science units

39. I use a variety of instructional strategies and approaches in teaching science.

- yes, but want more

42. Financial support for science in my district is sufficient.

- can always use more monies
- what is "sufficient"?
- if I turned in more
- only science literature materials, our text is a 1983 edition
- no
- due to grants our building has received

TEACHER COMMENTS WRITTEN ON SURVEYS

- I wold like to know of grants available. I must purchase my own supplies. Small districts have no $ for supplies
- I'm not sure
- only what we get from ESC

43. Science materials/supplies are readily available for my use.

- in areas where I've scraped it together, not district-supplied
- we have supplies for our units but not for experiments children show interest in doing
- West 40 has enabled us to have lots of equipment
- Carol VanDeWalle has a ton of stuff I could use
- because of the grant
- because of my principal
- some
- my own
- we can always use new equipment/materials
- very old textbooks
- that's why kits are so great!(those in science kits ARE, books are not!)

44. Administrators' attitudes toward science are positive.

- this is true for my principal, but not at top administration
- who knows

45. Student discipline is easily maintained.

- not always easily
- have most of the time
- on some days, not
- student discipline is very easily maintained
- not this year!
- some classes; depends on the clientele

46. I can select support materials (library books, films, computer software, etc.) for science instruction.

- to a certain dollar amount
- would like more!
- I'd like more computer software
- sometimes
- only at my own expense
- sometimes there is a limited amount of funds
- from ESC, no $ locally

47. Science equipment is adequate for our needs

- adequate for our units, not for exploration
- present is wearing out, expensive to replace
- I would like a few more
- almost
- my own equipment
- at my own expense
- most of the time
- no
- only in kits

48. Class sizes are appropriate for science teaching.

- too big
- large class size is a safety hazard, sometimes we have over 30! Should never be more than 25!
- smaller groups for hands-on: 30 with varying abilities makes it very difficult
- would like smaller groups
- so far, but who knows how long it will last
- except for next year; class will be too large
- we have small classes
- absolutely TOO large, I'm not sure about other grades
- this year, yes; last year, NO!
- NO!!!

49. Adequate numbers of student science texts, etc. are available.

- although we don't use texts much
- want more literature
- ?
- we wrote our own journals
- hands-on science, no texts
- textbooks too old

50. My classroom has a sufficient number of tables or desks for all students to conduct science activities.

- NO!

TEACHER COMMENTS WRITTEN ON SURVEYS

- we have a lab I can go to; the lab is available on a limited basis. Lower grades need better facilities.
- not

51. My classroom has a sufficient number of tables or desks for all students to conduct science activities.

- yes, except when sizes reach over 27
- individual desks only
- would LOVE more tables!
- outlets!
- we are trying to get a primary science room started
- no room
- we use the floor
- we go to the lab
- NO!

56. Teaching science is . . .

- teaching in general is stressful when one has to worry about drugs, guns, mental illnesses, lack of parental support, etc.
- my enthusiasm has increased as I attend more hands-on workshops and become more familiar and begin developing my 3-4 curriculum. This is our first year of implementing more of a hands-on approach rather than text program.
- too many students this year
- no equipment
- I can see where a lot of these would be more important at higher levels of learning than 2nd grade
- stressful in gathering all material together
- stressful when experiments do not work right!

Parental Involvement

12. My students' parents are involved in science education within our school.

- at home, with take home activities
- we haven't really asked
- some
- we do a family science night once a year

15. My students' science assignments include parent/family involvement.

- our parents want school work done at school
- sometimes
- parent supervision or participation is sometimes required

School-Community Relations

13. Business/Community is involved with science education within my school.

- somewhat
- we haven't asked
- in other classes, too
- Comm. Ed.
- some; local dentist and doctors, weatherman

16. Community individuals/organizations provide science supplies, talent, and equipment for my school.

- rarely
- a little
- have limited #, want more
- only the ESC Grant project has helped
- Henry CO Farm Bureau
- Science Literacy grant
- small items
- in some classrooms, not necessarily mine

37. People from the community are utilized for class or individual research projects.

- more of
- sometimes I like to try to do this; it lends a feeling of connectedness
- no
- I've had a nurse and a bee-keeper
- it varies throughout the building
- none available

TEACHER COMMENTS WRITTEN ON SURVEYS

Random Comments:

- we are a middle school - grades 6-8 - our data may or may not reflect a K-6 situation.
- I suppose I could always do more, storage is sometimes a problem but I'm working it out.
- I love teaching Science!!
- I wish there was more time in our schedule for science.
- science knowledge and resources have been limited for too many years for elementary education.
- assessment is definitely an area that we are working on and trying to improve
- we have financial support, materials/supplies available and I can select support materials we need, all because of the Science Literacy grant over the past few years.
- working on using performance items, interviews with students and performance checklists more
- My style of teaching has totally changed since being involved in the target school. The students are so interested in science, I try to integrate it into almost all lessons. I was afraid of science before.
- science is enjoyable and exciting; that is most important to me

The Teacher is the Key

What science education will be for any one child for any one year is most dependent on what the child's teachers believes, knows and does -- and doesn't believe, doesn't know and doesn't do. For essentially all the science learned in school, the teacher is the enabler, the inspiration, and the constraint. (NSF Report Number 083-003763 - Stake, R. and Easley, J., University of Illinois).

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